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AN ANNOTATED LIST OF THE WASPS OF ALBERTA

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As a group, the wasps which inhabit the North American continent have not attracted very widespread interest, despite the excellent accounts of the habits of various species which have been published by such careful observers as the Raus, the Peckhams and other writers.

This, possibly, is due to the fact that relatively few of the numerous species appear to have a very direct relationship with insects that are considered to be of great economic importance. Exceptions to this general rule are found in such genera as *Podalonia* (*Ammophila*) and *Sphex*, which are conspicuous in their activities while hunting for cutworms and in, subsequently, dragging them to their subterranean nests.

Many other species are, however, far more abundant than are the representatives of these two genera. The majority of them stock their nests with various plant-feeding insects and their depredations upon the latter must have a considerable effect upon the number which survive a fairly lengthy annual hunting season.

For this reason, if for no other, it is desirable that more be known regarding the wasp population which inhabits the different regions of this continent. Up till the present time, there has been very little information published regarding the wasp fauna of the Canadian prairies. In 1925, W. Carter, who was then a student under Dr. C. Mickel at St. Paul, Minn., made a fairly intensive collection of Sphecoidea in the neighbourhood of Lethbridge, Alberta. In addition, he borrowed for study the collection of the Dominion Entomological laboratory located in that city, as well as that of this University. In consequence he was able, with the assistance of Drs. Mickel and Rohwer, to publish[1] a list of 47 species of Sphecoidea from Alberta. This constitutes the only list of wasps taken in the prairie provinces which has ever been published. Additional records, taken from the literature, bring the total for this province to less than sixty. The University collection, however, contains records of over 170 species. It appears, therefore, to be desirable that all records which we possess regarding the species which are now known to inhabit this part of Canada be brought together for publication.

SOURCES OF ADDITIONAL RECORDS

Practically every record in the following list, with the exception of a few which have been culled from the literature, refers to material now in the University of Alberta collection. The majority of these have been captured by the compiler. Reference is made later to the valuable assistance rendered by Mr. J. Carr in collecting for us in the Medicine Hat area.

ACKNOWLEDGEMENTS

With the aid of such literature as is available to us, together with reference to authoritatively determined specimens from elsewhere, attempts are made at the University to name all locally captured specimens. From time to time, specialists have generously re-examined the accumulated material in certain groups and have confirmed or have modified our determinations. Their invaluable assistance is, herewith, gratefully acknowledged. In the following list, the initials of the authority who first confirmed or named a species for the collection are placed immediately after the recorded name. In a few cases, the

[1]Carter, W. Can. Ent., Vol. 57, PP 131-136. 1925.

initials of a second authority, who has re-examined specimens and has confirmed the original identification, are added.

In every instance in which re-examination resulted in a modification of a *published* record from this province, both of the proposed names are recorded, with the assumption that the earlier one was incorrect. Corrections which have been made in the literature are not recorded and the most recently employed name, only, is listed. When determinations which have been made by the compiler are confirmed or modified by an authority, the initals of the latter, only, are given. Thus, when an "E. S." appears after a record this means that there has not been an opportunity to submit the specimens so recorded to an authority for re-examination.

The names of each authority for which initials are employed in this list are as follows:—

J. B. J. Bequaert, Boston, Mass.
N. B. N. Banks, Cambridge, Mass.
W. B. W. G. Bodenstein, Ithaca, N.Y.
W. C. W. Carter, St. Paul, Minn.
H. E. H. E. Evans, Ithaca, N.Y.
H. F. H. T. Fernald, Amhurst, Mass.
C. M. C. E. Mickel, St Paul, Minn.
D. M. D. Murray, St. Paul, Minn.
V. P. V. S. L. Pate, Ithaca N.Y.
E. S. E. H. Strickland, Edmonton, Alta.
G. S. G. Sandhouse, Washington, D.C.
H. S. H. A. Scullen, Corvallis, Ore.
H. T. H. Townes, Takoma Park, Md.

Method of recording Localities and Dates of Capture.

An asterisk precedes the name of each species represented in the U. of A. collection. No information, other than locality and date of capture, is given for records based on literature.

In order to save space, localities in Alberta are given by a system of Arabic numerals. These conform with the Ecological Areas into which the province was divided, and each of which was described in some detail, by the writer in his List of the Diptera of Alberta[2]. A town or feature has been selected in each of these relatively small areas. Each can be considered as the "name" locality which is indicated by the numeral. The majority of captures have been made within a few miles of the town named. A few specimens, however, may have been taken up to 50 miles from the town itself, though in the same general ecological environment.

Numerical locality records can, therefore, be interpreted as follows:—

1. *Cypress Hills* Located in S. E. Alta., partly treed, elevation up to 4,500 ft. Probaby never competely glaciated.
2. *Medicine Hat,* 3. *Lethbridge*: Short-grass prairie. Former dry, extensively sandy; latter about 50% irrigated.
4. *Vermilion,* 5. *Drumheller,* 6. *Calgary*: Short to long-grass prairie.
7. *Wainwright,* 8. *Red Deer*: Parkland, about 50% aspen poplar groves: 70% cleared, now producing grain.
9. *St. Paul,* 10. *Edmonton*: Mixed Aspen and Spruces about 60% cleared, now producing grain.
12. *Athabaska,* 15. *Beaverlodge*: Mixed northern forest and parkland.
16. *Edson,* 17. *Cochrane*: Foot-hill areas.
18. *Waterton,* 19. *Banff,* 20. *Nordegg,* 21. *Jasper*: Mountainous areas.

Of these areas, the most interesting is No. 2, Medicine Hat and vicinity. Here the soil is largely sandy and the rainfall is very light. Associated with this area is that of No. 1, the Cypress Hills, which, very possibly, may have played an important part in determining the presence of a most unexpected collection

[2]Strickland, E. H. Can. Journ. Research. Vol. 16. pp. 175-219. 1938.

of animals and plants in this general locality. Nowhere else, to the east of the Rocky Mountains do such creatures as scorpions, solpugids, black widow spiders, termites, horned toads, hog-nosed vipers and kangaroo rats occur in Canadian latitudes, with the exception of termites in southern Ontario. To this surprising list can be added several of the less spectacular wasps which are recorded from the same area in the following list.

I feel sure Dr. Bequaert will not object to my recounting that when, in 1938, I sent him a small collection of Vespoidea containing two or three specimens, not taken by myself, from this area, he returned them unnamed since they appeared to be mislabelled. These, at that time, were believed to be confined to the Sonoran of Texas and vicinity. In consequence, I visited Medicine Hat in 1939 and collected rather intensively in this group. Among my captures, Dr. Bequaert found no less than six species which, in the past, had been considered to occur only in the Sonoran. The war prevented any further collecting on my own part but I was fortunate in obtaining the services of Mr. J. Carr, a student at the University who resided in Medicine Hat, to make general insect collections there during the following two summers. A number of the unusual records of wasps from this area are the result of his energetic collecting.

Following Arabic numerals denoting localities, the months during which adults have been taken are indicated by Roman numerals.

Hence, the record "*Oxybelus coloradense Bak. (V. P.) = N. emarginata Say (W.C.) 2-5. VI-VII" is interpretable as "Represented in the U. of A. collection; so determined by Dr. V. S. L. Pate, who has re-examined specimens determined for us by Dr. W. Carter, and is of the opinion that his published record of *N. emarginata* should be corrected to read *O coloradense*. Adults have been taken in the vicinity of Medicine Hat, Lethbridge, Vermilion and Drumheller during June and July."

There is disagreement, even among recent writers, as to the relationship between, as well as to the taxonomic position of, various groups of "wasps".

In the following list, the grouping employed is:—

Series *ACULEATA*.

Pronotal angles extending nearly or quite to the tegulae. *VESPOIDINI*
  Venation much reduced. *Serphoidea*.
  Venation fairly complete.
    Abdomen with five or more segments.
      Petiole without scale. *Vespoidea*.
      Petiole with scale. *Formicoidea*. (Not listed here.)
    Abdomen with three segments. Pronotal angles somewhat removed from tegulae. *Chrysidoidea*.
Pronotal angles remote from tegulae. *SPHECOIDINI*
  Body vestiture simple. Hind basitarsi not wider than remaining tarsal segments. *Sphecoidea*
  Body vestiture plumose. Hind basitarsi appreciably wider than remaining tarsal segments. *Apoidea*. (Not listed here.)

VESPOIDINI

SERPHOIDEA. (*PROCTOTRUPOIDEA*)

This somewhat anomalous family does not appear to be very well represented in Alberta. Though it would appear that there are about a dozen species represented in the University collection, we are unable to name them ourselves and have failed to find any specialist who is willing to do so for us.

*Helorus paradoxus Prov. (H.T.) 10 VIII.
Pseudomethoca propinqua Cr. 2, 3. VIII.
Telenomus mesillae Cock. 3. VIII.
Reported as an egg parasite of a bug *Chlorochroa sp.*

VESPOIDEA.

Tiphiidae.

*Chyphotes albipes Cr. (J.B.) 2. VII-VIII.

B & Z Library

*Myrmosa unicolor Say (J.B.) 2, 10. VII-VIII.

Mutillidae.

*Dasymutilla bioculata Cr. (C.M.) 2-4. VII-IX.
* canella Bl. (C.M.) 7. VI.
* caneo Bl. (C.M.) 2. VII-VIII.
* fulvohirta Cr. (C.M.) 2-4.V-IX.
* harmonia Fox (C.M.) 7. VII.
* macra Cr. (C.M.) 2. VII-VIII.
* monticola Cr. (C.M.) 2-4. VI-IX.
* nigripes sparsa Fox (C.M.) 2. VII-VIII.
* vesta Cr. (C.M.) 2, 3, 7. V-IX.

Ephuta conchate Mick. 3.

*Pseudomethoca propinqua Cr. (C.M.) 2, 3. VII-VIII.

Pompilidae (*Psammocharidae*).

In 1939, Dr. N. Banks determined the species which were, at that time, represented in the collection. In 1947, Mr. H. E. Evans, of Cornell University asked for the loan of Pomplini in connection with a projected revision of this tribe. He has very kindly, sent us in advance of his publication, a list of the species which he has found to be represented. He modifies certain of Banks' concepts as to generic and specific dispositions, and the names which he sent us are employed as the basis for the following list. Alternative specific names employed by Banks are given in parentheses.

We have, in addition, a few specific determinations by Banks on which we have no later report. These are recorded under the names which he employed even though, in the case of several, it is probable that Evans may place them in other genera.

*Ceropales cressoni Fox. (H.E.) 1, 2. VII-VIII.
* fraterna Sm. (N.B.), (H.E.) 2, 10, 20. VIII.
*Cryptocheilus terminatus Say (N.B.) 2, 3. VII-VIII.
*Deuteragenia caliptera Say (N.B.) 12. VI.
*Priocnemis alienata Sm. (N.B.) 10. VII-VIII.
* arcuata Bnks. (H.E.) 2.
* occidentalis Bnks. (H.E.) 17.
* pompilia Cr. (H.E.) 2.
*Pseudargenia metallica Bnks. (N.B.) 2, 10. VII-IX.
*Aphorinellus completus Bnks. (H.E.) 2, 5. VI.
*Sophropomilus consimilis Bnks. (H.E.) 2.
* ingenuus Cr. (N.B.) 2. VIII.
* padrinus Vier. (H.E.) 2.
* parvus Cr. (N.B.), (H.E.) 2, 10. VIII.
* rufibasis Bnks. (N.B.), (H.E.) 10, 12. VI-VII.
* subangulatus Bnks. (N.B.), (H.E.) 10. VIII.
*Nannopompilus argenteus Cr. (N.B.) 7. VI.
*Pompilus angularis Bnks. (H.E.) 5. VI.
* apicatus Prov. (H.E.) =elisnore & cylindricus (N.B.) 3, 4, 7, 10, 12. V-VIII.
* arctus Cr. (H.E.) 10. VI.
* imbecillus Bnks. (H.E. 2, 10.
* luctuosus Cr. (N.B.), (H.E.) 2, 5, 10. VI-IX.
* parvulus Bnks. (H.E.) 2.
* septentrionalis Kinc. (H.E.) = lasiops (N.B.) 8, 10, 21. VI-VII.
* scelestus Cr. (N.B.), (H.E.) 1, 2, 5, 7, 10, 18. VI-IX.

Psammochares anoplinus Bnks. 22. VII.

*Pompilinus hageni Bnks. (N.B.) 9, 10. VII-VIII.
* insolens Bnks. (H.E.) 2.

* marginatus Say (N.B.), (H.E.) 2. VI-VIII.
* tenebrosus Cr. (H.E.) = A. compacta (N.B.) 1-3, 10 15, 17. V-VIII.
*Anoplius imbellis Bnks. (H.E.) 2.
* ithaca Bnks. (H.E.) 2.
* nigerrimus Scop. (H.E.) = P. clystera (N.B.) 10. VII.
* tarsatus Bnks. (N.B.), (H.E.) 2. VIII-IX.
* virginiensis Cr. (H.E.) 10.
*Episyron biguttatus Fab. (N.B.), (H.E.) 1, 3, 8, 10, 12. VI-VII.
* quinquenotatus Say (N.B.), (H.E.) 2, 3, 8, 10, 12. VI-VIII.

Sapygidae.

A few specimens representative of this family have been taken in Alberta.. We have found no authority who is willing to name these for us. From such literature as is available to us they appear to be the following species.

*Sapyga aculeata Cr. (E.S.) 19. VIII.
* martini Sm. (E.S.) 10. VII.
* nigripes Cr. (E.S.) 3. VII.
* pumila Cr. (E.S.) 2. VI.

Masaridae.

*Pseudomasaris marginalis Cr. (J.B.) 19. VIII.

A single specimen of this species was taken near Lake Louise in 1927.

Eumeridae.

*Ancistrocerus antilope Panz. (J.B.) 5, 10, 18. VI & VIII.
catskillensis deS. 3, 18.
*albophaleratus deS. (J.B.) 1-8, 19, 12, 15, 18-21. V-IX.
10, 12, 15, 18-21. V-IX.

This is, by far, the commonest Eumenid in Alberta. It has been recorded as nesting in old Cynipid galls on oaks, but we have taken it from a clay bank where it was associated with a colony of *Anthophora.*

* tigris albolacteus Beq. (E.S.) 18, 19. VIII.
* waldenii Vier. (J.B.) 2-5, 10, 12, 19-21. VI-VIII.
*Odynerus (Odynerus) aldrichi Fox (J.B.) 2, 7, 10. VI-VIII.
* dilectus Saus. (J.B.) 3, 10, 15, 19, 20. V-VIII
* (Rygchium) annulatus geminatus Cr. (J.B.) 2, 3. VIII.
* leucomelas Saus. (J.B.) 8, 10, 12, 15, 16. VI-VIII.
* dorsalis stricklandi Beq. (J.B.) 2. VII-IX.
* planitarsis Boh. 10. VII.
* (Stenodynerus) anormis Say (J.B.) 2, 3. VI-IX.
* vagus Saus. (J.B.) 1, 2. VIII.
*Symmorphus albomarginatus Saus. (J.B.) 2, 8, 10, 12, 20. VI-VIII.
* canadensis Vier. (J.B.) 8, 10. VI-VIII.
* cristatus Saus. (J.B.) 10, 12. VI-VIII.
*Pterocheilus decorus Cr. (J.B.) 2, 3. VII-VIII.
* quinquefasciatus Say (J.B.) 2, 3. VII-VIII.
Eumenes bolli Cr. 2. VIII.
coloradensis Cr. 18.
* nearcticus Beq. (J.B.) 2, 4, 6, 8-10, 12, 15, 18, 19. VI-VIII.

Though widespread in Alberta, this species is nowhere common.

stricklandi Beq. 1. VIII.
* verticalis Say (J.B.) 2, 3, 18. VI-VIII.
neoboreus Beq. 2, 21. VIII.

Vespidae.

*Polistes fuscatus connectens Beq. (J.B.) = variatus Cr. 2-4 IV-IX.

This species is abundant around Medicine Hat and in the badlands of the Red Deer River, but is less so at Lethbridge. It is most frequently

encountered in river bottoms, where it nests largely in old tin cans. The workers are very docile and the cans can be kicked around without signs of retaliation. On one occasion, in August, about forty males were found crowded into a large crack in a telephone pole. A single female was found flying around a room on Christmas day at Edmonton, three hundred miles to the north of the known distribution of the species. Nothing, in so far as was known, had been taken into the house from southern Alberta.

*Vespula adulterina deB (J.B.) 1, 10, 12, 19. VI-VIII.
* arctica Roh. (E.S.) 1, 12, 15. VIII.
* arenaria Fab. (J.B.) 1-4, 8-10, 12, 17-20. V-VIII.

This is the commonest species throughout Alberta. It is very vicious and may attack, without having been molested in any way, at a distance of several feet from its nest. Its habit of nesting inside the walls of loosely constructed summer cottages renders it a very unpleasing adjunct of lake-side camps.

* fernaldi Lew. (J.B.) 20. VII.
* austriaca Pnz. (J.B.) 12, 19, 20. VI-VII.

This "parasitic" species is rather common in the mountainous areas. Elsewhere, it appears to be confined to wooded territory.

* maculata L. (J.B.) 4, 8, 10, 19. V-VIII.
* norwegica norwegicoides Slad. (J.B.) 1, 10, 12, 19, 20. VI-VIII.
* pennsylvanica deS. (E.S.) 2, 3. III-IX.
* rufa atropilosa Slad. (J.B.) 3, 20. VII.
* consobrina Saus. (J.B.) 1, 4, 6, 8, 10, 12,17-19. V-VIII.
* sladeni Beq. (J.B.) 20, 21. VII.
* vulgaris L. (J.B.) 1, 3, 8, 10, 12, 15, 19, 20. V-IX.

CHRYSIDOIDEA.

*Chrysidea verticalis Patt. (W.B.) 2, 10. VI-VII.
*Chrysis caerulans Fab. (W.B.) 2, 10. V-VI.
* dorsalis Aar. (E.S.) 2, 5, 10. VI-VII, IX.
* hilaris Dahl. (E.S.) 2. V.
* kansensis Vier. (W.B.) 3, 5. VII-VIII.
* nitidula Fab. (E.S.) 2, 18. VI-VIII.
* nortoni Aar. (E.S.) 10. VII.
* pacifica Say (W.B.) 10. VI.
* perpulchra Cr. (W.B.) 2, 10. VII.
* provancheri Sch. (W.B.) 10. VI.
* semicuprea Vier. (W.B.) 10. VII-VIII.
* venusta Cr. (W.B.) 8, VI.
*Diplorrhos plicatus Aar. (W.B.) 2, 5, 15. V & VII.
* variatus Aar. (W.B.) 2, 7, 9, 10, 15. VI-VII.
*Elampus marginatus Pat. (W.B.) 2, 3, 6, 7, 10, 15, 17. V-VIII.
* viridicyaneus Nort. (W.B.) 10. V & VII.
*Hedychridium viride Cr. (W.B.) 3, 6, 19. VII-VIII.
*Hedychrum cupricolle Cr. (W.B.) 2, 3. VI-VIII.
* violaceum Br. (W.B.) 2, 10, 12. VII-VIII.
*Holopyga ventralis Say (W.B.) 2, 10. V-VII.
*Omalus iridescens Nort. (W.B.) 10. VII.
* laeviventris Cr. (W.B.) 10, 19. VI-VIII.
* sinuosus Say (W.B.) 2, 8, 10, 12, 15. V-VII.

SPHECIODINI

SPHECOIDEA.

Nyssonidae.

*Gorytes albosignatus Fox (V.P.) 2, 10. VI.
* asperatus Fox (V.P.) 7. VI.
* decorus Fox (E.S.) 10. VII.
* simillimus Sm. (V.P.) 8, 10. VII.

Hoplisus elegantulus Sm. 10. VII.
*Nysson rusticus Cr. (E.S.) 2, 3. VII-IX.
*Ochleroptera bipunctata Say (V.P.) 2, 10. VIII.
*Psammoecius pygidialis Fox (V.P.) 2. VIII.
* spilopterus Hand. (W.C.), (V.P.) 2, 3. VIII.

Psenidae.

*Psen clypeatus Fox (E.S.) 2, VIII.
* cressoni Pack. (E.S.) 2, VI.
* granulosus Fox (E.S.) 10. VII-VIII.
leucopus Say 12. VIII.
mixtus Fox 19. VI.
* psychrus Pate (E.S.) 8, 10. VI-VII.
* pygidialis Mall. (E.S.) 10. VI-VII.

Oxybelidae.

*Belomicrus forbesii Rob. (V.P.) 1, 12. VI-VIII.
*Oxybelus abdominale Bak. (V.P.) 2, 4. VII-VIII.
* coloradense Bak. (V.P.) = N. emarginata (W.C.) 2 ,3, VI-VII.
* quadrinotatum Say (W.C.), (V.P.) 1-3, 10. VI-VIII.

A specimen was observed carrying a small fly on its sting to its nest in a sandy bank. The fly was lost during its capture.

* montanum Rob. (E.S.) 3. VII.
* subulatum Rob. (V.P.) = albosignatus Sm. (W.C.) 2, 3. VIII.

Thyreocopidae ("*Crabronidae*").

The old Genus "*Crabro*", in so far as it is represented in America was separated by Ashmead[3], in 1899 into a number of distinct genera. Several more recent writers reunited the majority of these into a single genus, to which the name "*Solenius*" has been applied as a result of the transference of the name "*Crabro*" to a genus of sawflies. With certain modifications, Ashmead's sub-divisions have been re-established and are employed by Dr. Pate in the determination of Albertan material[4]. His generic nomenclature is employed in the following list. Species of which we have literature records only are left in a non-committal group "*Solenius*", which is not synonymous with *Solenius* as defined by Ashmead.

*Lindenius armaticeps Fox (V.P.) 3. VI-VII.
* c. errans Fox (V.P.) 2, 3, 17. VI-VIII.
*Blepharipus harringtoni Fox (V.P.) 21. VII.
*Clytochrysus lapidarius Pzr. (V.P.) 10, 12. VI-VIII.
* nigrifrons Cr. (V.P.) 10, 20. VII.
*Ectemnius brunneipes Pack. (V.P.) 10, 12. VI-VII.
* corrugatus Pack. (W.C.), (V.P.) 10, 12, 15. V-VIII.
* dives L & B. (V.P.) = montanus (W.C.) 8, 10, 12, 15, 21. V-VIII.
*Crossocerus angelicus Kin. (V.P.) = vierecki. 2, 3, 8, 10. VII-VIII.
* lentus Fox (V.P.) 10. VI.
* maculiclypeus Fox (V.P.) 2, 7. VI.
* nigricornis Prov. (V.P.) 10, 12, 18. VI-VII.
* planipes Fox (W.C.), V.P. 2, 3, 10. VI-VII.
*Euplilis coarctata Scop. (V.P.) 10. VI.
*Hypocrabro chrysarginus L. & B. (W.C.), (V.P.) 10, 12, 18, 20. VI-VIII.
* continuus Fox (V.P.) 8, 10, 12. VI-VII.
* spiniferus Fox (V.P.) 2. V.
* trifasciatus Say (V.P.) 1, 8, 10, 12, 15. VI-VIII.
*Lestica interrupta L. & B. (V.P.) 3. VIII.
* producticollis Pack. (V.P.) 7, 8, 10, 12. VI-VIII.
*"Norumbega" argus Pack. (V.P.) 12. VII.

[3]Ashmead, Can. Ent. Vol. 31. pp. 163-174, 212-220. 1899.
[4]Pate, Am. Mid. Nat. Vol. 31. No. 2. pp. 329-348. 1944.

*Paranothyreus cognatus Sm. (V.P.) 2. VIII.
*Pemphilis advena Sm. (V.P.) 8. VIII.
* latipes Sm. (W.C.), (V.P.) 2-5, 8, 10, 15, 18, 19. VI-VIII.
* monticola Pack. (V.P.) 8. VII.
* tenuis Fox (W.C.), (V.P.) 18. VI-VII.
*Protothyreopus bigeminus Patt. (V.P.) 2, 3. VII-VIII.
* dilectus Cr. (W.C.), (V.P.) 1-4, 7, 12. VI-IX.
* rufifemur Pack. (W.C.), (V.P.) 3. VI-VIII.
*Stictoptila maculipennis Sm. (V.P.) 8, 10, 12. VI-VIII.
*Synothyreopus tenuiglossus Pack. (V.P.) 8, 10. VII-VIII.
"Solenius" albertus Cart. 18. VII.
ater Cart. 18. VII.
drymocallidis Roh. 10. VI-VII.
florissantensis Roh. 18. VII.
pratus Cart. 3. VI.
sayi Cock. 8, 10, 12, 18, 20. VII-VIII.
seamansi Cart. 18. VII.
veles Cart. 10. VII.

Philanthidae.

*Aphilanthops frigida Sm. (V.P.) 2, 3. VI & VIII.
*Philanthus annae Dun. (V.P.) 2. VIII.
* bilunatum Cr. (N.B.), (V.P.) 1-3, 6, 8, 10. VII-VIII.
* flavifrons Cr. (N.B.), (V.P.) 2, 3. VIII.
* frontalis Cr. (N.B.) 2, 3. VIII.
* gibbosum Feb. (N.B.), (V.P.) 2, 3. VIII.
* gloriosum Cr. (N.B.), (V.P.) 2. VIII.
* inversum Patt. (N.B.), (V.P.) 2, 3. VIII.
psyche Dunn. 2.
* pulchrum D. T. (V.P.) 2. VI.
* punctatum Say 2. VIII.
* vertilabris Fab. (N.B.), (V.P.) 3. VII-VIII.

Trypoxylonidae.

*Trypoxylon aldrichi Sans. (G.S.) 18. VII.
* frigidum Sm. (G.S.). (V.P.) 2, 10, 15. VI-VII.

Mellinidae.

*mellinus abdominalis personatus Fox (G.S.), (V.P.) 2, 3. VI & VIII-IX.
One specimen was carrying an Anthomyid when captured.

Sphecidae.

*Ammobia ichneumoneum L. (V.P.) 2. VII-VIII.
*Prionony x atratum LeP. (V.P.) 2, 3. VIII.
* pubidorsum Cost. (V.P.) = C. bifoveolatum Tas. (W.C.) 1-3. VI-VIII.
* thomae F. (V.P.) 2. VIII-IX.
*Podalonia argentifrons Cr. (H.F.), (D.M.) 2, 7. VI.
* communis Cr. (D.M.) 4, 6, 18. V-VII.
* luctuosa Sm. (H.F.), (D.M.), (V.P.) 1-8, 10, 15, 17-21. IV-VIII

This is by far the commonest and most widespread species in this family and it has gained general recognition as an important predator on cutworms.

* mexicana Saus. (D.M.) 2, 3. V-VIII.
mickeli Murr. 3, 6, 15. VII.
* occidentalis Murr. (D.M.) 2, 4, 18. VII-VIII.
* robusta Cr. (D.M.) 1, 10, 12, 15. VI-VIII.
* sericea Murr. (D.M.) 2, 7. VIII.
* sonorensis differentia Murr. 3. VI.

* valida Cr. (H.F.), (D.M.) = grossa Cr. (W.C.) 2-4, 6. VII-VIII.
* violaceipennis Lep. (W.C.), (D.M.), (V.P.) 1-8, 10, 12, 15, 18. VI-IX
*Sphex aberti Hald. (D.M.), (V.P.) 2, 3. VI-IX.
* arvensis Dal. (D.M.), (V.P.) 7, 8, 10, 15, 18, 20. VI-VII.
* breviceps breviceps Sm. (D.M.), (V.P.) 3, 4. VIII.
* harti Fern. (V.P.) 7. VI.
kennedyi Murr. 4. VII.
* mediatus Cr. (V.P.) 1, 18. VII-VIII
* parapolitus Fern. (V.P.) 2, 7. VIII-IX.
* pilosus Fern. (V.P.) 1-4, 7. VI-IX.
nudus Murr. 2, 3, 21. VI-VIII.
* politus Cr. (D.M.) 3, VI.
* procerus Dahl. (D.M.) 2, 4, 7. VII-VIII.
* urnarius Dahl. (D.M.), (V.P.) 1, 2, 7. VI-VIII.
*Chalybion californicum Sas. (V.P.) 2. VI.
*Sceliphron caementarium Dru. (V.P.) 2. VI & IX.

Larridae.

*Larropsis distincta Sm. (E.S.) 2. VIII.
*Tachysphex ashmeadii Fox (V.P.) 2. VIII.
* dubius Fox (E.S.) 2. VIII.
* fuscus Fox (E.S.) 2, 4. VII-VIII.
* granulosus Mick. (W.C.) 3, 10. VI-VIII.
* punctifrons Fox (W.C.) 2, 3, 7, 10. VI-VIII.
* tarsatus Say (V.P.) 2, 4, 7. VI-IX.
* tenuipunctus Fox (E.S.) 2, 3. VII-VIII.
* terminatus Sm. (E.S.) 2, 5. VI & IX.
zimmeri Mick. 3. VIII.
*Tachytes hesperus Bnks. (V.P.) 2. VIII.
* pepticus Say (W.C.) 3. VII-VIII.
* sayi Bnks. (V.P.) 2, 3. VI-VIII.

Astatidae

*Astata aspera Fox (V.P.) 2-4. VII-IX.
* caerulea Cr. (V.P.) 2. VII.
* nevadica Cr. (V.P.) 2, 3. VI-VIII.
* nubecula Cr. (W.C.), (V.P.) 1-3, 5. VI-IX.
*Diploplectron bidentatum Ash. (E.S.) 2. VI.
*Plenoculus nr. davisii Fox (E.S.) 5, VI.
*Solierella foxi Vier. (V.P.) 2. VI-VII.

Pemphredonidae.

*Stigmus americanus Pack. (E.S.) 8, 10, 19. VII-VIII.
*Pemphredon angularis Fox. (E.S.) 18, VIII.
* inornatus Say (E.S.) 5, 8, 10, 12, 15, 19. VI-VII.
* nearcticus Koh. (E.S.) 10. VII.
* rileyi Fox (W.C.) 18. VII.
Xylocelia adamsi Tit. 18. VII.
* ater Mick. (E.S.) 10. VII.
* bidentatus Roh. (E.S.) 5, 10. VI.
* florissantensis Roh. (E.S.) 4. VIII.
* metathoracicus Mick. (E.S.) 5. VI.
* siouxensis Mick. (E.S.) 2, 3. VI-VII.
*Passaloecus annulatus Say (E.S.) 10. VI-VII.
* mandibularis Cr. (E.S.) 10, 19. VI & VIII.
*Miscophus americanus Fox (V.P.) 7. VI.
*Bothynostethus ?distinctus Fox (E.S.) 10. VII.

Bembicidae.

*Stizoides unicinctus Say (W.C.), (V.P.) 2, 3. VIII.
*Stictiella emarginata Cr. (W.C.), (D.M.), (V.P.) 2, 3. VII-VIII.
* speciosa Cr. (V.P.) 2. VIII.
* spinifera Mick. (V.P.) 2. VIII.
*Bicyrtes ventralis Say (D.M.), (V.P.) 10. VII-VIII.
*Bembix comata Park. (E.S.) 3. VII.
* primaaestate J. & R. (D.M.), (V.P.) 2, 3, 7, 10, 12. VII-VIII.
* spinolae Say (W.C.), (D.M.) 2-4, 10, 12, 15. VII-IX.
*Microbembex monodonta Say (V.P.) 2. VII-VIII.

Cerceridae.

*Cerceris deserta Say (H.S.) = occiputomaculata (W.C.) 2, 3. VII-IX.
* fulvipediculata Cr. (H.S.) 2. VII-VIII.
* imitatoria Sch. (N.B.) 9. VI.
* nigrescens Sm. (W.C.), (H.S.) 2, 3, 10, 15. VI-VIII.
* rufinoda Cr. (E.S.) 2. VII-VIII.
crucis V. & C. 2. VIII.
*Eucerceris flavocincta Cr. (H.S.), (V.P.) 2. VI & VIII.
* fulvipes Cr. (H.S.) 2, 3. VII-VIII.
* Cr. (gloriosa) Recorded by Sladen from Medicine Hat. Probably was a reference to *Philanthus gloriosum* Cr., which is abundant in this area.
* superba Cr. (W.C.), (H.S.) 2, 3. VIII.
* bicolor Cr. (H.S.) 2, 3. VIII.

This species is extremely abundant around Medicine Hat. All of the females which have been seen are of the red *bicolor* variety.

STATUS OF THE LARCH SAWFLY, *PRISTIPHORA ERICHSONII* HTG. IN THE PRAIRIE PROVINCES*

BY R. R. LeJEUNE,
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HISTORY AND DISTRIBUTION

Extensive stands of young tamarack throughout the forested areas of the Prairie Provinces are currently menaced by the depredations of this serious defoliator. Owing to the importance of the insect, this paper was prepared with the object of: (1) reviewing briefly available information concerning the present outbreak in the Prairie Provinces, (2) clarifying some of the main issues frequently raised, and (3) describing the investigations in progress in the Prairie Region.

Definite records of injury by the larch sawfly in North America date back to 1881. In that year the insect was reported from Massachusetts by Hagen (9). Whether this species was introduced from Europe, as is often supposed, is difficult to say, but judging by references in the literature to defoliation of tamarack, it would appear that the sawfly may have been active on this continent as long ago as the beginning of the Nineteenth Century (1). Jack (12) in a report published in 1885 states that some 30 years previously his father observed tamarack woods to be entirely defoliated in Quebec. Studies of annual growth rings in Minnesota indicate the possible occcurrence of sawfly outbreaks there about 1840, 1855-60 and 1870. Finally, we have the authority of Marlatt and MacGillivray (13, 14) that a sawfly described under another name in 1860 is synonymous with the larch sawfly. All this evidence indicates that this insect has existed on this continent much longer than generally supposed.

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In Canada, very serious outbreaks have at some time destroyed nearly all mature tamarack east of the Rockies. Fletcher (4) describes an outbreak in Eastern Canada which commenced in 1882 and wiped out "millions of acres" of tamarack. Since that time many records of sawfly occurrence and outbreaks can be found in the literature.

The Prairie Region, as is well known, did not escape the depredations of this insect. Hewitt (10) in 1909 and 1910 noted that most of the tamarack along the Canadian Pacific Railway, almost as far west as Winnipeg, had been stripped. Similar defoliation was also reported to him from North Battleford, Saskatchewan in 1910. In 1911, Norman Criddle detected the sawfly in the Spruce Woods Forest Reserve, Manitoba, and it appears to have struck Riding Mountain National Park in the same year. This first recorded outbreak in the Spruce Woods lasted until about 1920. Swaine (15) again reported its presence in northern Saskatchewan but provided no dates. A second great outbreak in Manitoba apparently lasted from 1924-28, but the records are somewhat indefinite. The third and current epidemic apparently originated about 1938 when it was reported from the Spruce Woods Forest Reserve by Dr. R. H. Handford of the Dominion Entomological Laboratory, Brandon.

The present outbreak has been particularly severe in certain areas of Manitoba and Saskatchewan. As noted above, it seems to have originated in central Manitoba, and its outer fringes now extend into eastern Saskatchewan and northwestern Ontario. It has not yet reached into Alberta. Feeding has, of necessity, been confined to stands of immature tamarack which have reoccupied swamps which were stocked with more mature timber prior to the comparatively recent waves of destructive sawfly outbreaks.

These stands of young tamarack, while of no real commercial consequence now, have great potential value providing they can be saved until they are of merchantable size. In Western Canada tamarack is generally regarded as a useful species. If trees of sufficient size were available, tamarack would be in heavy demand for railroad ties, bridge timbers and other construction purposes. Trees of smaller diameter, up to 6″ and 7″, would be used extensively for fence posts and possibly fuel wood. Tamarack is also important in that it occupies land which might otherwise be wastes of sphagnum or muck. This tends to give uneconomic land an economic future, and at the same time serves to play an important role in water conservation and watershed perpetuation. The main obstacle to the realization of these direct and indirect benefits of tamarack is the larch sawfly.

DESCRIPTION AND LIFE-HISTORY

The sawfly overwinters in the ground as a larva or "grub" protected by a thick, tough, parchment-like cocoon. The cocoons are light to dark brown in colour, capsule-shaped, from three-sixteenths to one-half inch in length, and may be found from near the surface to a depth of some 6 inches, depending upon the cover. In the spring the larvae transform in the cocoons successively to pupae and adults, the latter emerging to deposit eggs during late May, June and early July.

The female adult sawfly, somewhat over three-eighths of an inch in length, is black with a wide bright orange band around the abdomen. Mating is not necessary for reproduction, a phenomenon that enables the species to multiply very rapidly under favourable conditions. Extensive rearings at the Winnipeg Laboratory give a ratio of somewhat less than one male to every hundred females.

The eggs are deposited at the tips of young tamarack shoots, in double rows, usually along the underside of the twig. The female cuts slits into the shoot with her ovipositor and lays a small translucent egg in each slit. The oviposition injury retards the growth on the side of the twig containing eggs, while the opposite side continues to grow, causing the tip to curl characteristically.

The eggs soon swell, hatch in about a week, and the larvae begin feeding in clusters on the needles, completely stripping the foliage as they move along. The larvae are black-headed, with the body greyish-green in colour above and paler beneath. In the Prairie Provinces, tamarack is the only host on which the larch sawfly has been observed to feed.

Full-grown larvae measure about three-quarters of an inch in length. The earliest larvae reach maturity by midsummer, when they drop to the ground and spin their cocoons in the moss or litter beneath the tree. The greater part of the feeding is completed by the end of July, but occasional clusters of late larvae may be found feeding throughout August.

HABITS OF ATTACK AND EFFECT ON TREES

The larch sawfly larvae cause weakening or death of the trees by feeding on the needles. Apparently the sawfly adults or larvae react positively to light for defoliation usually starts at the tip of the crown. For this reason, lightly to moderately defoliated stands may present an unduly alarming appearance due to stripped crowns. The lower portions, however, bear a proportionately much greater amount of foliage and trees should be able to withstand such feeding for many years.

In a heavy infestation, on the other hand, defoliation proceeds at an amazing pace and within a period of a month or so trees may be completely stripped. When this occurs, a second crop of weak needles may be put forth late in the season. The following season the needles are usually smaller and sparser than normal. Repeated heavy defoliation produces successively weaker foliage until in four or five years the affected trees produce only a fraction of their normal needles. In certain respects this progressive reduction of foliage serves as a protective measure by slowly starving the sawfly population and reducing its numbers. This gives the trees a much needed opportunity to recover some of their vigour.

Sample plot studies in progress since 1941 indicate that stands of young tamarack can survive repeated extremely heavy defoliation. Where tree mortality did occur, at least three successive years of over 90 per cent defoliation were required, while a large number of other trees subjected to equally severe stripping have thus far survived. Out of four sample plots established, dead trees have occurred in only one, the most heavily attacked, to the extent of 5 per cent of the stand. This plot has experienced average defoliations through the years 1941-46 as follows: 12, 73, 50, 92, 80 and 46 per cent, but despite this continued heavy loss of needles only a small percentage of the stand has been killed.

CONTROL AND SALVAGE

In dealing with the larch sawfly, at least three avenues of control are being actively explored, namely, the use of natural enemies, chemicals, and cultural methods. Unfortunately, experimentation has not reached the stage where it can be stated with certainty that any or all of these methods can be applied successfully over extensive areas, but progress is being made.

It appears that biological or natural control of the current outbreak in this region has not yet met expectations. This statement is made despite the startling early success achieved by an European parasite, *Mesoleius aulicus* Grav., introduced into Manitoba from 1912-14, and the relatively high incidence of this and other parasite species being found in the larch sawfly in some other parts of Canada (5, 11). In theory, natural control of the larch sawfly should be relatively simple and permanent, but in practice inexplicable difficulties are encountered. The parasite, *Mesoleius*, after being liberated in the Spruce Woods and Riding Mountain areas became well established. In the Spruce Woods it showed rapid steady gains (2) which were climaxed by a parasitism of some 88 percent in 1927 as determined by Mr. E. B. Watson of the Dominion Division of Entomology. For this reason *Mesoleius* was credited as a dominant factor in controlling that particular outbreak. Very little was then heard of either the sawfly or the parasite until the current outbreak developed.

Investigations conducted throughout the course of the present epidemic indicate that while the parasite has survived and dispersed throughout the major sawfly areas of Manitoba, the degree of parasitism has been disappointingly low. Repeated rearings of collections from different areas between 1939 and 1945 by both the Dominion Parasite Laboratory at Belleville and the Winnipeg Laboratory have yielded parasitism figures from .01 per cent to 5.1 per cent. Recent studies show that the actual proportion of sawfly larvae parasitized is considerably higher but only about 10 per cent of the parasites survive to kill the host eventually. Should this be a permanent condition, it might possibly be rectified by the introduction of more vigorous *Mesoleius* strains from other parts of Canada.

The possible use of other insect parasites, predators, and disease is not being overlooked. A parasitic fly, *Bessa harveyi* Tns., introduced in quantity between 1939 and 1942, has become well established but has not spread very far from liberation centres. Its dispersal may have to be actively assisted. The release of other species is also under consideration by the Forest Insect Unit and the Dominion Parasite Laboratory. Mice and shrews at present destroy more cocoons than do the parasites. Where the nesting of these mammals is favoured in suitable well-drained swamps, the destruction of the overwintering cocoons has varied between 10 per cent and 60 percent with an average of 37 per cent being recorded in Manitoba between 1939 and 1945. In wet areas, feeding on cocoons by mammals is negligible.

Chemical control on a small scale is being studied in the event that its use should become necessary in extreme cases. Chemicals might be advantageously employed where incipient outbreaks are detected, or where particularly valuable stands are threatened. Although of a very preliminary nature, these small scale ground experiments with DDT and benzene hexachloride (666) at rates of ½, 1 and 2 pounds per acre gave excellent results. The ½ pound per acre rate was almost as effective as the 2 pound rate, but for large scale operations involving the use of aircraft it would probably be advisable to use at least 1 pound per acre to obtain better coverage. Immediately after application, the more volatile benzine hexachloride seemed to be more effective, but after a period of three weeks the residue of DDT, on the whole, retained greater killing power than the benzene hexachloride. In practice, both insecticides probably would be equally effective.

A third method under investigation involves the regulation of water levels in swamps. This may, if successful, be applicable to easily accessible stands. Observations on defoliation and preliminary experimental evidence indicates that submergence of cocoons in water for a limited period of time may be lethal to the sawfly. Observation records of swamps with high water levels during June and July invariably show tamarack to be free from sawfly damage even in areas with large sawfly populations. The use of such a method will, of course, have to be very thoroughly studied as regards its effectiveness, practicability, and effect on growth of tamarack.

The judicious control of water levels offers promise, not only from the standpoint of direct control, but also indirectly by providing suitable habitats for small predatory mammals. Further investigations will, no doubt, disclose optimum water levels conducive to the highest survival of the sawfly. Below this level, the nesting of mice, shrews, and voles would be encouraged and, where flooding is not possible due to insufficient water, surface drainage might have a beneficial effect.

In the event that extensive tamarack mortality occurs before control can be successfully applied, the question of salvage becomes of paramount importance. Unfortunately many of the present stands are so immature as to be of little commercial value. On the other hand, any dead tamarack which is of merchantable size offers splendid opportunities for salvage. Since dead tamarack may remain sound for longer periods than most soft woods, salvage

operations could be carried on over extended periods. Various reliable reports indicate that extreme caution should be exercised in pronouncing tamarack as dead. Indeed, if credence can be placed on such reports, tamarack snags, apparently dead for many years, have been observed to put forth new needles. As long as there is no evidence of deterioration by wood-borers, bark beetles, disease, or loosening of the bark, the status of "dead" trees may be in doubt. Moreover, in the absence of positive signs of deterioration within a few years after death, it is probable that the wood is still largely sound.

REFERENCES

1. Audubon,J. Delineations of American scenery and character, pp. 204-5. G. A. Baker and Co. New York 1826.
2. Criddle, N. The introduction and establishment of the larch sawfly parasite, *Mesoleius tenthredinis* Morley, into southern Manitoba. Can. Ent. 60:51-53. 1928.
3. Dowden, P. B. The parasites of larch sawfly in western Montana and Great Lakes region. Jour. Ec. Ent. 30:381. 1937.
4. Fletcher, J. Report of the Entomologist and Botanist. Dept. Agric., Dom. of Canada, 1905.
5. Graham, A. R. The present status of the larch sawfly (*Lygaronematus erichsonii* Hartig) in Canada, with special reference to its specific parasite, *Mesoleius tenthredinis* Morley. Can. Ent. 63 (5) : 99-102. 1931.
6. Graham, S. A. The influence of small mammals and other factors upon the larch sawfly survival. Jour. Ec. Ent. 21:301-310. 1928.
7. Graham, S. A. The larch sawfly as an indicator of mouse abundance. Jour. Mammalogy. 10 (3):189-196. 1929.
8. Graham, S. A. Principles of forest entomology, pp. 190-191. McGraw-Hill Book Company, New York. 1939.
9. Hagen, H. A. Entomological notes. Can. Ent. 13:37. 1881.
10. Hewitt, C. G. The large larch sawfly. Can. Dept. Agr. Div. Bul. 10 (2nd series). 1912.
11. Hopping, G. R., H. B. Leech, and V. G. Morgan. The larch sawfly, *Pristiphora erichsonii* (Hartig) in British Columbia, with special reference to the cocoon parasites. *Mesoleius tenthredinis* Morley and *Tritneptis klugii* (Ratzeburg). Sc. Agr. 24 (2): 53-63. 1943.
12. Jack, J. G. Notes of 1885 on some injurious and other common insects. Ann. Rep. Ent. Soc. Ont. 17:16-17. 1887.
13. MacGillivray, A. D. The Hymenoptera or wasp-like insects of Connecticut. Bull. 22, Conn. Geol. Nat. Hist. Survey. 1916.
14. Marlatt, C. L. Revision of Nematinae of North America. Tech. Ser. U. S. Div. Ent. Bull. 3. 1896.
15. Swaine, J. M. Shade tree and forest insects in Manitoba. Agr. Gaz. Can. 4 (9):755-63. 1917.
16. Watson, E. B. The larch sawfly. Can. Dept. Agr. Div. For. Ins. Sp. C. (3P). 1931.

A *PSITHERUS INSULARIS* QUEEN IN A *BOMBUS MIXTUS* NEST

On June 2, 1946, I was digging into a compost heap, made of weeds and sods in 1945, and soon came upon a bumble bee's nest. It was in a clean and apparently unused mouse nest, eight inches from the surface of the pile, and entered by a tunnel opening on the northwest corner. There were seven cells, two of them empty.

The queen and three of the four small workers were captured and sent to E. R. Buckell of Kamloops, who is listing the species known to occur in this Province. He identified the workers as *Bombus mixtus* Cresson and the queen, which presumably had killed and supplanted the *mixtus* queen, as *Psitherus insularis* (Smith). He further remarked that there are few Nearctic records of *Psitherus* queens being found actually in *Bombus* nests.

Hugh B. Leech.

Vernon, B. C.

NOTES ON THE MENOPONIDAE OF NORTH AMERICA. I.

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This is the first of a series of papers dealing with the Menoponidae of North America, in which it is hoped that each genus can be discussed and illustrated. The author wishes to acknowedge the kindness of Dr. G. F. Ferris in lending the Stanford Collection, containing V. L. Kellogg's type material, which is being used in these studies; and of Dr. C. F. W. Musebeck, for the loan of material from the United States National Museum.

Genus **EIDMANNIELLA** Keler, 1938

Eidmanniella Keler, Annales Musei Zoologica Polonici, XIII, p. 81-85 (1938)

Head about twice as broad as long; the lateral margin of the forehead with a slit. Mandibles situated a short distance behind the anterior margin. Oesophageal sclerite either well developed or rudimentary. Antennae four-jointed. *Thorax* normal; mesonotum short, separated from the metanotum. Legs normal; hind femora each with a patch of setae on the venter. Abdomen elongately oval with tergal, sternal, and paratergal plates; sternites IV-VI with small patches of setae on their lateral margins. *Male genitalia* with the basal plate short, narrow anteriorly, and gradually broadened toward the apex where it is strongly expanded; parameres present.

Occurring on Sulidae, Phalacrocoracidae, Fregatidae, and Phaetontidae.

Genotype: *Monopon pellucida* (Rudow).

EIDMANNIELLA PELLUCIDA (Rudow, 1869)

Figs. 2, 10, and 13

Menopon pellucidum Rudow, Zeit. f. ges. Naturw., XXXIV, p. 400, (1869)
Menopon brevipalpe Piaget, Les Pediculines, p. 498, pl. 40, f. 5, (1880)
Menopon brevipalpe Piaget; Waterston, Annales S. Afr. Mus., X, p. 314 (1914)
Menopon brevipalpe Piaget; Harrison, Parasitology, IX, p. 34 (1916)
Menopon pellucidum Rudow; Harrison, *ibid*, p. 42
Menopon brevipalpe Piaget; Bedford, 18th Rept. Dir. Vet. Serv. and Anim. Ind. S. Africa, p. 372 (1932)
Menopon pellucidum Rudow; Bedford, *ibid*, p. 375
Eidmanniella brevipalpe (Piaget); Keler, Annales Musei Zoologica Polonici, XIII, p. 81-85 (1938)
Eidmanniella pellucidum (Rudow); Keler, *ibid* p. 81-85
Eidmanniella brevipalpe (Piaget); Clay and Rothschild, Novitates Zoologicae, XLI, p. 306 (1939)
Eidmanniella pelucida (Rudow); Bedford, Ondestepoort Journ. Vet. Sci. and Anim. Indust., XII, p. 125-126 (1939)
Eidmaniella brevipalpe (Piaget); Thompson, Ann. and Mag. Nat. Hist., ser. 11, V, p. 53 (1940)
Menopon pellucida Rudow, Thompson, *ibid*, p. 53

Type Host: *E. pellucida* was described from speciments from *Phalacrocorax capensis* (Sparrman) and *E. brevipalpe* from specimens from *Phalacrocorax carbo carbo* Linn. Specimens from *Phalacrocorax carbo carbo* Linn. were examined (no locality data) and are included in this study because this species is the type of the genus and the host is found on the northeastern coast of North America.

EIDMANNIELLA SINGULARIS (Kellogg and Kuwana, 1902)

(Figs. 4, 5, 6, 7, 12, and 16)

Menopon singularis Kellogg and Kuwana, Proc. Wash. Acad. Sci., IV, p. 485, pl. 31, f. 1 (1902); Kellogg, Trans. Amer. Ent. Soc. XXXII, p. 321 (1906); Kellogg and Mann, Ent. News., XXIII, p. 65 (1912); Harrison, Parasitology, IX, p. 44 (1916); Ferris, Bernice P. Bishop Mus. Bull. 92, p. 59, t.f. 11 a-g (1932)
Eidmaniella singularis (Kellogg and Kuwana); Keler, Annales Musei Zoologica Polonici, XII, p. 81 (1938); Bedford, Ondestepoort Journ. Vet. Sci. and Anim. Indust., XII, p. 126 (1939); Guimaraes, Arz. do. Mus. Para., IV, p. 182, t.f. 2-2 (1945)

Kellogg and Kuwana described this species from specimens taken off *Anous stolidus stolidus* (Linn.)—the Galapagos Islands. Kellogg recorded it

from *Phaethon aethereus* ssp., *Sula variegata* (Tschudi), *Sula nebouxi* Milne-Edwards, and *Phoebetria palpebrata palpebrata* (Forster)—the Galapagos Islands. Kellogg and Mann listed it from *Phaethon aethereus* ssp.—Baja California. Ferris collected it from *Fregata minor* ssp.—Marquesas Islands; and Guimaraes from *Fregata manificens rothschildi* Mathews from Parana, Brazil.

I have examined Kellogg's series of specimens and have found one male with data "*S. cyanops*, 15°N-130°W." His specimens from *Phaethon aethereus* (no locality) are *Austromenopon sternophilum* (Ferris); and the specimens from the same host with the locality as Pasa Robles, California, are *Austromenopon becki* (Kellogg). The specimens from *Phoebetria palpebrata palpebrata* (Forster) are probably stragglers. The specimen, figured and described by Kellogg and Kuwana in their original description, is a male and not a female as stated by them. The records by Ferris and Guimaraes pertain to *E. singularis* (K. and K.).

EIDMANNIELLA KUWANI (Kellogg and Chapman, 1902)

Figs. 3, 8, and 14)

Menopon kuwani Kellogg and Chapman, Journ. N.Y. Ent. Soc., X, p. 25, pl. III, f. 4, (1902); Harrison, Parasitology, IX, p. 39 (1916); Essig, Insects of Western N. A., p. 128 (1926)
Amyrsidea kuwani (Kellogg and Chapman); Peters, Bird-Banding, VII, p. II (1936)
Eidmanniella kuwani (Kellogg and Chapman); Keler, Annales Musei Zoologica Polonici, XIII, p. 85, (1938); Bedford, Onderstepoort Journ. Vet. Sci. and Anim. Indust., XII, p. 125-126 (1939); Thompson, Ann. and Mag. Nat. Hist., ser. II, V, p. 53 (1940)

Kellogg and Chapman described this species from specimens from *Phalacrocorax penicillatus* (Brandt) from California. Peters recorded the species from *Phalacrocorax auritus auritus* (Lesson) from Georgia and Illinois.

I have examined the type specimens recorded and described by Kellogg and Chapman.

EIDMANNIELLA PUSTULOSA (Nitzsch, 1818)

(Figs. 1, 9, 11, and 15)

Menopon pustulosum Nitzsch, Magaz. f. Ent. von Germar und Zinken III, p. 440 (188); Giebel, Zeit. f. ges. Nat., XXVIII, p. 393 (1866); Giebel, Insect Epizoa, p. 298 (1874); Piaget, Les Pediculines, p. 490, pl. 41, f. 3, (1880); Mjoberg, Arkiv. for Zoologi, VI, p. 34 (1910); Waterston, Annales of the S. Afr. Mus., X, p. 314 (1914); Harrison, Parasitology, IX, p. 44 (1916); Bedford, 18th Rept. Dir. Vet. Serv. and Anim. Indu. Un. S. Afr., p. 375 (1932)
Eidmanniella pustulosum (Nitzsch), Keler, Annales Musei Zoologica Polonici, XIII, p. 81-85 (1938); Bedford, Ondestepoort Journ. Vet. Sci. and Anim. Indust., XII, p. 125 (1939); Thompson, Annls and Mag. Nat. Hist., ser. 11, V, p. 51 (1940)

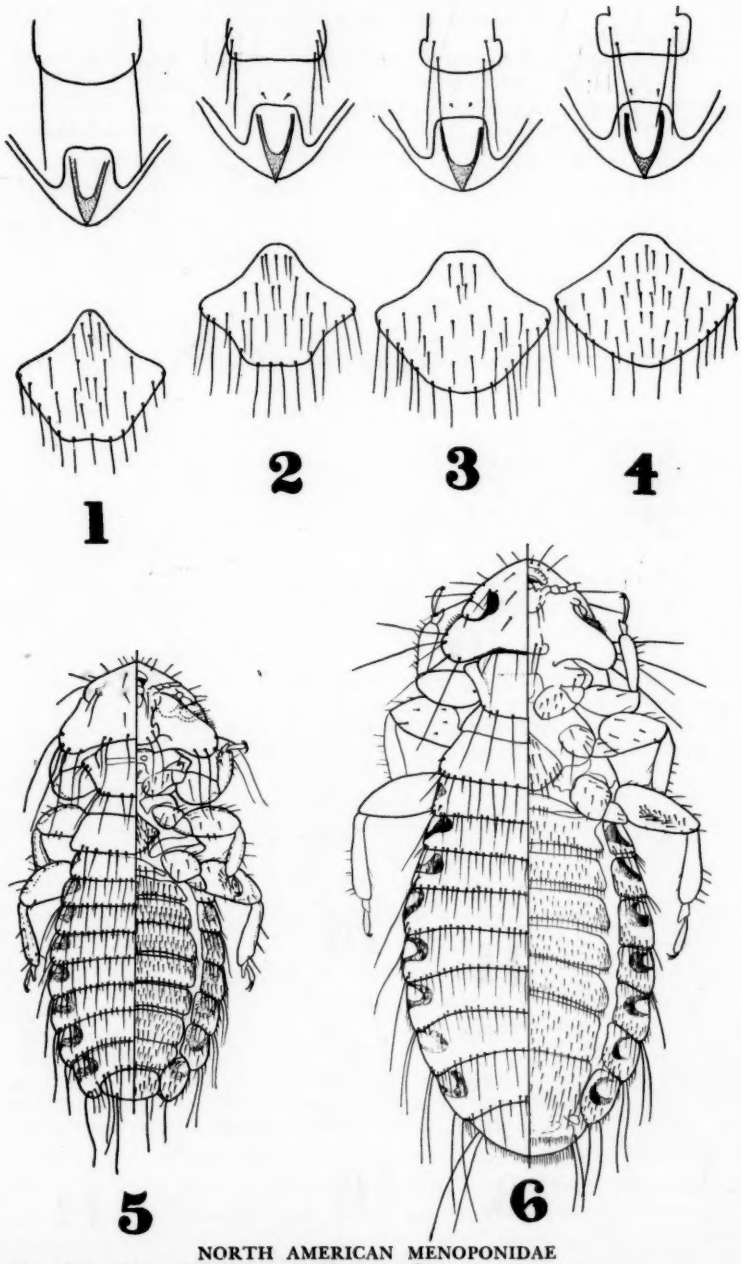
A small series of one male, one female, and an immature form from *Morus bassana* (Linn.), the type host, from the Bonaventure Islands was examined. This is the first record of this species from North America.

DISCUSSION

These four species are very closely related; however, they can be separated by a comparative study of the heads, gular regions, and thoracic sternal plates. In chaetotaxy and form of the female genitalia, the species are very similar. I have seen the males of *E. singularis* (Kellogg and Kuwena) and *E. pustulosum* (Nitzsch), which are figured. The accompanying figures and table of measurements illustrate the slight differences.

TABLE NO. I

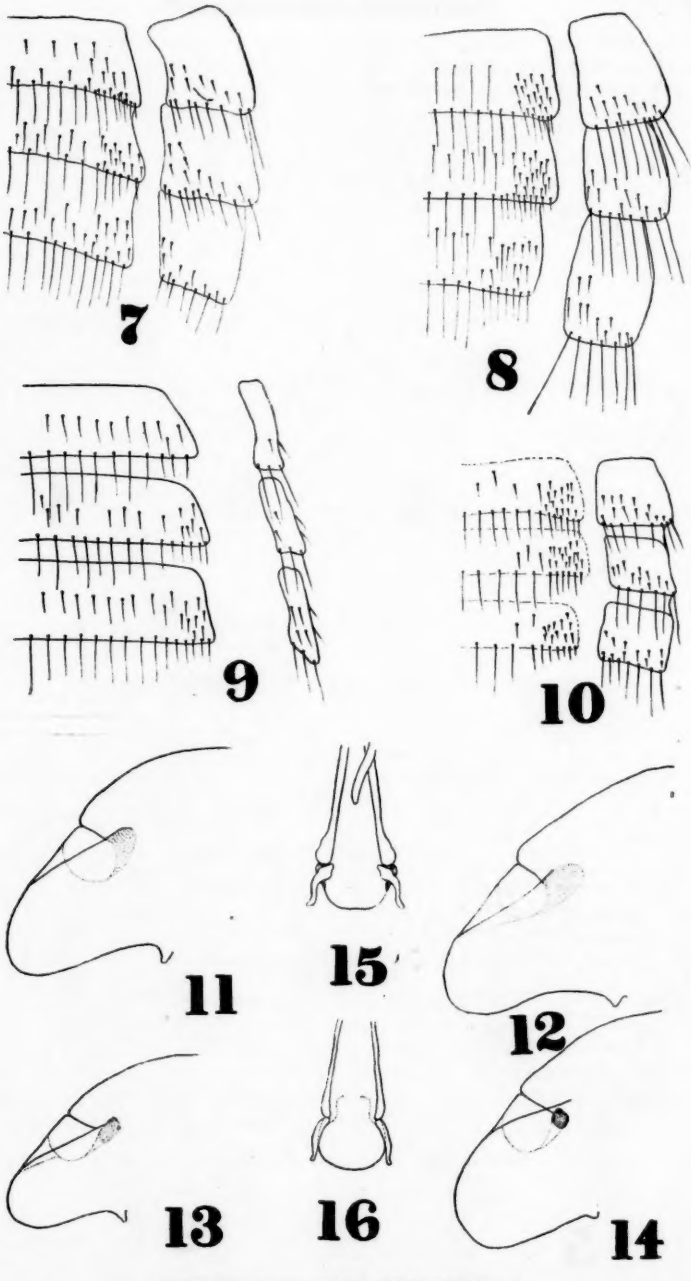
Length	*kuwani* female	*pellucidum* female	*singularis* female	*pustulosum* female	*singularis* male	*pustulosum* male
Head	.240mm	.360mm	.372mm	.360mm	.372mm	.300mm
Prothorax	.300	.300	.276	.300	.228	.240
Meta-Mesothorax	.204	.300	.300	.300	.250	.240
Abdomen	1.632	1.620	1.620	1.740	.960	.960
Total	2.376	2.580	2.568	2.700	1.810	1.740
Width						
Head	.732mm	.720mm	.780mm	.756mm	.696mm	.612mm
Prothorax	.708	.576	.600	.612	.480	.456
Meta-Mesothorax	.720	.792	.780	.780	.600	.552
Abdomen	1.140	1.116	1.080	1.164	.792	.756



NORTH AMERICAN MENOPONIDAE

Figs. 1-4 Gular region and thoracic sternal plates of *Eidmaniella* spp.: Fig. 1, *E. pustulosa*. Fig. 2, *E. pellucida*. Fig. 3, *E. Kuwani*. Fig. 4, *E. singularis*.

Figs. 5-6. *Eidmanniella singularis* (Kellogg and Kuwana): Fig. 5, Male. Fig. 6, Female (redrawn from Ferris, 1932).



NORTH AMERICAN MENOPONIDAE

Figs. 7-10, Abdominal segments III-V, ventrolateral aspect: Fig. 7, *E. singularis*. Fig. 8, *E. kuwani*. Fig. 9, *E. pustulosa* Fig. 10, *E. pellucida*.
Figs. 11-14, Half of head in outline, dorsal view: Fig. 11, *E. pustulosa*. Fig. 12, *E. singularis*. Fig. 13, *E. pellucida*. Fig. 14, *E. kuwani*.
Figs. 15-16. Male genitalia: Fig. 15, *E. pustulosa*. Fig. 16, *E. singularis*.

OTHER SPECIES IN THE GENUS

Eidmanniella albescens (Piaget) (Type host: *Moris serrator* (Gray))
Eidmanniella eurum (Piaget) (Type host: *Halietor niger* (Vieillot))
Eidmanniella eurygaster (Nitzsch) (Type Host: *Phalacrocorax olivaceus olivaceus* (Humboldt))
Eidmanniella giganteum (Rudow) (Type host: *Sula leucogaster* (Boddaert))
Eidmanniela sigmoidale (Picaglia) (Type host: *Phalacrocorax carbo lucidus* (Lichtenstein))
Eidmanniella subrotundum (Piaget) (Type host: *Phalacrocorax sulcirostris* (Brandt))

Genus **HELENOMUS** Ferris, 1916

Helenomus Ferris, Canadian Entomologist, XLVIII, p. 305-306 (1916)
Hoazineus Guimaraes, Arz. Zool. São Paulo, I. p. 311-317 (1940)

Head wider than long, front reduced and rounded. Lateral margins slightly swollen above the bases of the antennae. The temporal lobes rounded, reclined with the anterior margins set at a sharp angle to the longitudinal axis of the body. Pharyngeal scelerite and glands present. Antennae longer than normal, last segment conical.

Thorax with three segments, the mesothorax small, and the metathorax trapezoidal. *Posterior legs* with single delineated patches of setae on the ventral faces of the femora. Tibia of every leg with a row of small bristles on the external border of the distal portion.

Abdomen elongate, sternites and tergites each with a row of small setae along the posterior margin, and with numerous short stout hairs. Fifth sternite with a distinct patch of spines on each posterolateral angle.

Male genitalia with an extremely long slender basal plate. Parameres large and stout, with the distal tips bent outward.

Occurring mostly upon Gruiformes.

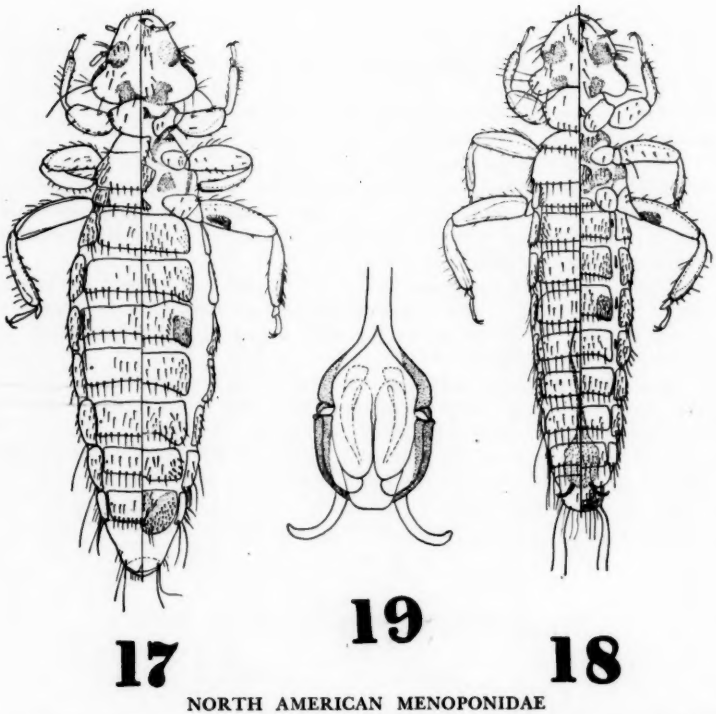
Genotype: *Colpocephalum truncatum* Piaget.

HELENOMUS ASSIMILE (Piaget, 1880)

(Figs. 17, 18, and 19)

Colpocephalum assimile Piaget, Les Pediculines, p. 544 (1880)
Osborn, Div. of Ent. U.S.D.A. Bull. V, p. 246 (1896):
Harrison, Parasitology, IX, p. 47 (1916)
Helenomus assimile (Piaget): Ferris, Canadian Entomologist, XLVIII, p. 305-306 (1916)
Colpocephalum assimile Piaget; Essig, Insects of Western N. A., p. 128 (1926)
Helenomus assimile (Piaget); Carriker, Lloydia, III (4), p. 291-292 (1940)

Osborne collected this species in Iowa and Colorado from the type host, *Grus americana* (Linn.). Essig, recorded it from the same host collected in Colorado. The specimens of latter record are probably part of the series lent to the author by Dr. Ferris. The host is very rare, hence there are few recorded collections. Carriker stated that he had specimens in his collection, but failed to give any other data; however, I believe them to be a part of the University of Nebraska series collected in Lincoln, Nebraska.



NORTH AMERICAN MENOPONIDAE

Figs. 17-19, *Helenomus assimile* (Piaget): Fig. 17, Female. Fig. 18, Male. Fig. 19, Male genitalia.

OTHER SPECIES IN THE GENUS

Helenomus absitum (Kellogg) (Type host: *Opisthocomus hoazin* (Muller)
Helenomus abdominale (Piaget) (Type host: *Grus vipio* Pallas)
Helenomus armiferum (Kelogg) (Type host: *Opisthocomus hoazin*) (Müller)
Helenomus harrisoni (Bedfordr) (Type host: Unknown)
Helenomus miandrium (Kellogg) (Type host: *Balearica pavonina gibbericep* Reichenow)
Helenomus truncatum (Piaget) (Type host: *Grus* spp.)

SARCOPHAGA RAPAX REARED FROM *PRIONUS CALIFORNICUS*

On September 12, 1939, an adult female of *Prionus californicus* Mots. was found on the ground by my son Robin; it was dead, but still fresh and relaxed. The beetle was "papered" and put into a box with other material for exchange. On December 29 four puparia were noted in the box, and traced to the *Prionus*. The maggots had left via the margin of the beetle's third visible abdominal sternite. Two flies emerged on January 10, 1940, one on Jan. 14, and one on February 1. I am indebted to G. J. Spencer who identified them in 1946 as *Sarcophaga rapax* Walk.

Hugh B. Leech,
Vernon, B. C.

HELOPS REGULUS IN A WASP'S NEST

On October 6, 1946, while hiking in the hills near Vernon, B. C., my son Tom and I found two wasps' nests (*Vespula* sp.). They were suspended two feet above the ground, in small bushes on the open range, and no adult wasps were seen. Each nest was about 7 inches high and 6 inches wide. Upon reaching home we gave one to another son, who immediately opened it to examine the combs. In so doing he discovered a beetle, and careful dissection showed ten more, all *Helops regulus* Blaisdell. They were active and hiding between the layers of the paper walls of the nest. Since the nests were first carried for a quarter of a mile, then left in the back seat of the car for four miles, it is possible that some beetles escaped. Their activity suggested that they might have been attracted to the nest not for hibernation, but by the combs, which contained dead wasp larvae, and a few live pupae in capped cells.

Hugh B. Leech,
Vernon, B. C.

ACETIC ACID ODOR FROM *STENOLOPHUS FIDELIS*

On October 8, I was collecting insects from under stones by a little pond on the Commonage road near Vernon. B. C. Small, shiny, black carabids were common, and several were picked up with tweezers and dropped into a vial of alcohol. Though the day was cold and windy, a smell of acetic acid was noticed and traced to the tweezers. The next carabid taken I incautiously held close to my nose: the odor it emitted choked me and made my eyes smart for a second. Other specimens were tested with due caution, and nearly all produced a puff or spray of acid. The smell was as pungent as ever I have experienced when disturbing a colony of red ants.

The beetles were identified as *Stenolophus fidelis* Casey by Wm. C. Stehr, to whom I am indebted. He wrote that he did not know of any records of *Stenolophus* species producing defensive scents.

Hugh B. Leech,
Vernon, B. C.

NOTES ON THE LIFE HISTORIES OF THREE FLORIDIAN BUTTERFLIES

BY RALPH L. CHERMOCK AND OTTILIE D. CHERMOCK
University of Alabama.

While collecting butterflies in southern Florida, we were successful in rearing many of the native species. In checking through the literature, no data could be found on the early stages of three of these, although d'Almeida[1] and Costa Lima[2] have published some notes on the metamorphosis of the Brazilian subspecies of *Appias drusilla*. It was thought, therefore, that it might be helpful to other Lepidopterists if we were to note our observations on the life histories of these butterflies.

Appias drusilla neumogenii (Skinner)

The eggs are deposited in groups of two or three on the underside of the young terminal leaves of Guiana Plum (*Dryapetes lateriflora*). This foodplant is a small tree belonging to the *Euphorbiaceae* and is generally found growing in the hammocks of southern Florida. Usually, the related members of this genus feed on plants belonging to the *Capparidaceae*. The eggs are bullet-shaped, slightly less than 1 mm. in height, with concave longitudinal flutings traversed by numerous fine striations. On oviposition, the color is white, changing to yellow before hatching. Upon emerging, the larvae are 1.5 mm. in length, brownish-yellow in color, with slightly lighter heads. The body is covered with rather long black hairs.

In the next to last instar, the body is green with a lateral, longitudinal, pale greenish-white stripe on each side. The last segment has two short distad projections covered with short black spines. Short black spines originating from small black spots cover the entire body. The head is rounded dorsally, narrowed ventrally, and also covered with short black spines.

The mature larvae are green in color. The head is covered with short, bluish-green spines; and the mouth-parts are yellowish. The body is covered with very fine yellow punctate markings and short bluish black spines on the dorsal and lateral surfaces. The lateral line is yellowish anteriorly and more white posteriorly. The ventral surface is pale green in color and clothed with whitish hairs. The last segment is bifurcated posteriorly into two short pointed protuberances. The adult larva is approximately 33 mm. long; the greatest diameter is 5 mm. In general, the shape is similar to that of *Pieris rapae*.

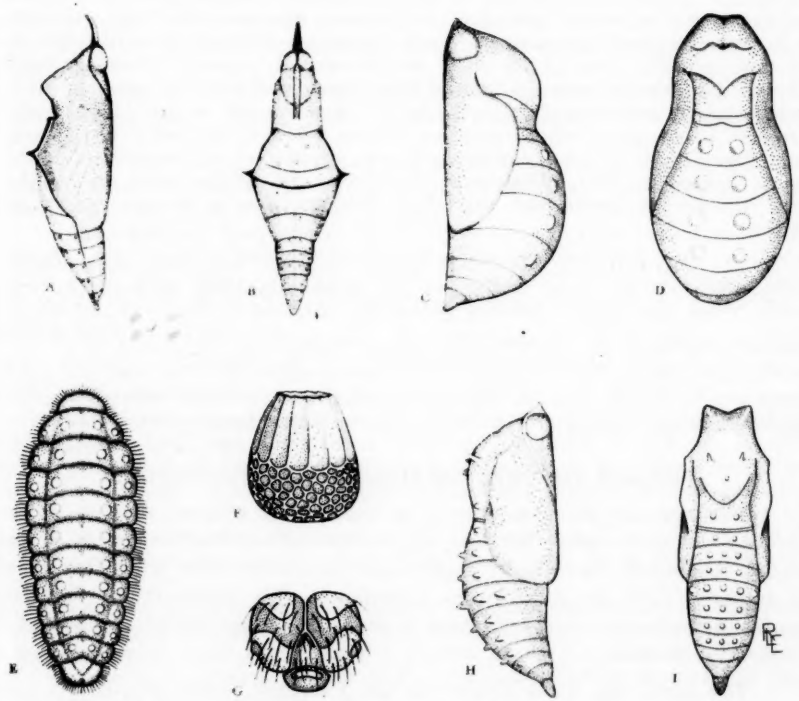
The chrysalid (fig. A and B) is pale gray-green in color, covered with very small reddish spots distributed particularly over the thorax and abdomen, dorsal to which is a row of black spiracles. On the dorsal surface of the abdomen is a longitudinal white midline on either side of which is a row of white spots, one to a segment. On the head is a black dorsal midline interrupted with white in the prothoracic region. The dorso-lateral spines are red-brown in color and margined with white. The interspaces of the wings have a pinkish hue.

Anthanassa frisia frisia (Poey)

The female deposits the eggs in groups of 25 to 80 on the lower surface of young leaves of *Beloperone guttata* (Shrimp Flower), an ornamental plant introduced from Mexico. The native foodplant is unknown. The eggs (fig. F) are pale green in color and similar in ornamentation and shape to those of *Phyciodes*. The dorsal half is concavely flutted longitudinally, while the lower half is deeply pitted. The larvae, on emerging are gregarious and feed at night on the lower surfaces of the leaves. The bodies, which are densely clothed with

1. Revisao do genero *Appias* (subgen. *Glutophrissa* Butl.) Bol. Biologica, Sao Paulo, vol. 4, pp. 56-57, 1939. Describes the life history and records the foodplant as *Capparis cynophalophora*.

2. Terceiro Catalogo dos Insectos que vivem nas Plantas do Brazil, p. 227, Rio de Janiero, 1936. Records the larvae as feeding on *Capparis* citing d'Almeida, and also "em *Cruciferae* e em *Cassia sericea*. (Biol.v. Prittw., 1865)." In checking the latter reference, we have been unable to find any mention of the life history of this species.



FLORIDIAN BUTTERFLIES

A, B, *Appias drusilla* neumogenii (Skinner), chrysalid; C, D, *Strymon acis bartrami* (Comstock and Huntingdon), chrysalid; E, S, *acis bartrami*, larva; F, *Anthanassa frisia frisia* (Poey), egg; G, *I. frisia frisia*, head, adult larva; H, I, *A. frisia frisia*, chrysalid.

long black hairs, are pale yellow in color changing to green after feeding; the heads are brown.

The head of the adult larva (fig. G) is yellowish-tan, the mouthparts brown, the eyes black. There are two crescent-shaped markings located on the dorso-anterior surface of the head. The head, which is small in comparison to the remainder of the body, is covered with short yellowish hairs. The first abdominal segment is narrow; the second expands rapidly to the maximum diameter which is continued to the last segment which again narrows abruptly. The ground color dorsally is gray with minute yellow spots. Longitudinally on the mid-dorsum runs a narrow black line; laterad to this on either side, but still dorsal, is a pale yellowish-white line bordered laterally with black. The spiracles are black, and there is a lateral whitish line at the juncture of the lateral and ventral plates. The ventral surface is grayish-white; the legs are yellowish. There are seven rows of spines arranged longitudinally on the body, and each spine in turn is covered with numerous thin hairs which give the larva an extremely hirsute appearance. These spines are grayish-yellow in color, and the hairs are black except for those on the second segment which are bright orange. One row of spines is located along the mid-dorsal line, starting on the fourth segment and extending to the last. On either side of this, still dorsal, is a row of larger spines which starts on the second segment and extends to the last. There is also a lateral row on each side, starting on the second and extending to the last segment. More laterad and ventrad to these rows, and slightly paler in color, is another row extending from the first to the next to the last segment.

The chrysalis (fig. H and I) is tan in color, becoming darker before emergence with the wing pattern of the adult appearing through the wing cases. There are slightly pointed projections anterior to the eyes and slightly raised tubercules along the antennal cases. On the dorsal surface of the abdomen there are three rows of spines on all but the two terminal segments. The spines on the fourth segment are larger, and there is an additional pair more laterally located. Spines are also found on the dorsal surface of the thorax.

Strymon acis bartrami (Comstock & Huntington)

The eggs are deposited singly on the flower stalks of *Croton linearis*. They are round, broadly flattened, and completely covered with numerous, three to five-sided, cone-shaped depressions. Numerous hairs which project at the angles give the egg a pubescent appearance. The top is lightly depressed around the micropyle but still marked with the ornate pattern. The egg is pearly gray in color.

The larva (fig. E) is typical for the Theclinae, being slug-shaped, pale gray-green in color, and covered with short hairs. There are four longitudinal rows of pale colored protuberances on the dorsal surface, each row having one such elevation to a segment. Apparently the larvae do not require the syngamus relationship of ants, as they could be reared successfully in captivity.

The chrysalis (fig. C and D) again is similar to those of other species of *Strymon*. The body is pale gray-green, covered with short hairs, and has slightly raised elevations, one to a segment, on each side of the dorsal midline of the abdomen. There is a black spot on the dorsal midline of the thorax. The head and thorax are covered with small irregular red dots, asymmetrically arranged. The abdomen is also speckled with more minute and more distantly placed red spots.

THE NUMBER OF GASTRIC CAECA IN SOME LARVAL SCARABAEOIDEA*

BY WILLIAM F. RAPP, JR.,*
Urbana, Illinois

During an examination of the internal anatomy of several specimens of scarabaeid larvae it was found that the gastric caeca varied in number and shape with the species being examined

Anatomically, gastric caeca are blind pounches varying in number and length and may occur on different parts of the ventriculus. Most commonly they occur at the anterior end surrounding the stomodaeal valve.

Generally speaking, we say that the gastric caeca are located near the anterior portion of the ventriculus and that the Malpighian tubules are located at the anterior end of the hind-gut. An anatomical study of the alimentary canal of the larval Scarabaeoidea shows that these generalizations do not hold in all groups.

The families of the Scarabaeidea are considered in the following phylogenetic arrangement (Leng 1920). Scarabaeidae, Trogidae, Lucanidae, and Passalidae.

In the Scarabaeidae, which is considered the most primitive family of Scarabaeoidea, five subfamilies were studied: Coprinae, Melolonthinae, Rutelinae, Dynastinae, and Cetoniinae.

The subfamily Corpinae is considered to be the most primitive of Scarabaeidae. A larvae of *Canthon pilularius* (Linn.) was studied and no trace of gastric caeca was found (fig. 1.) The alimentary canal is very long, about twice the length of the body. Possibly, because of the length of the canal, gastric caeca are not necessary.

The next subfamily studied was Melolonthinae and a species of *Phyllophaga* was studied. The fore-intestine is very short and on the anterior end of the ventriculus there are two gastric caeca (fig. 2).

The Rutelinae are considered to be slightly more advanced than the Melolonthinae and two species were studied. A larva of *Popillia japonica* Newn. (tribe Anomlini) was studied and it was found to have three sets of gastric caeca (fig. 3). The first set is on the anterior portion of the ventriculus and consists of a row of small caeca;the second set of gastric caeca is near the middle of the ventriculus and consists of four caeca in two groups. These are large lobes. Near the posterior end of the ventriculus is another small series of caeca.

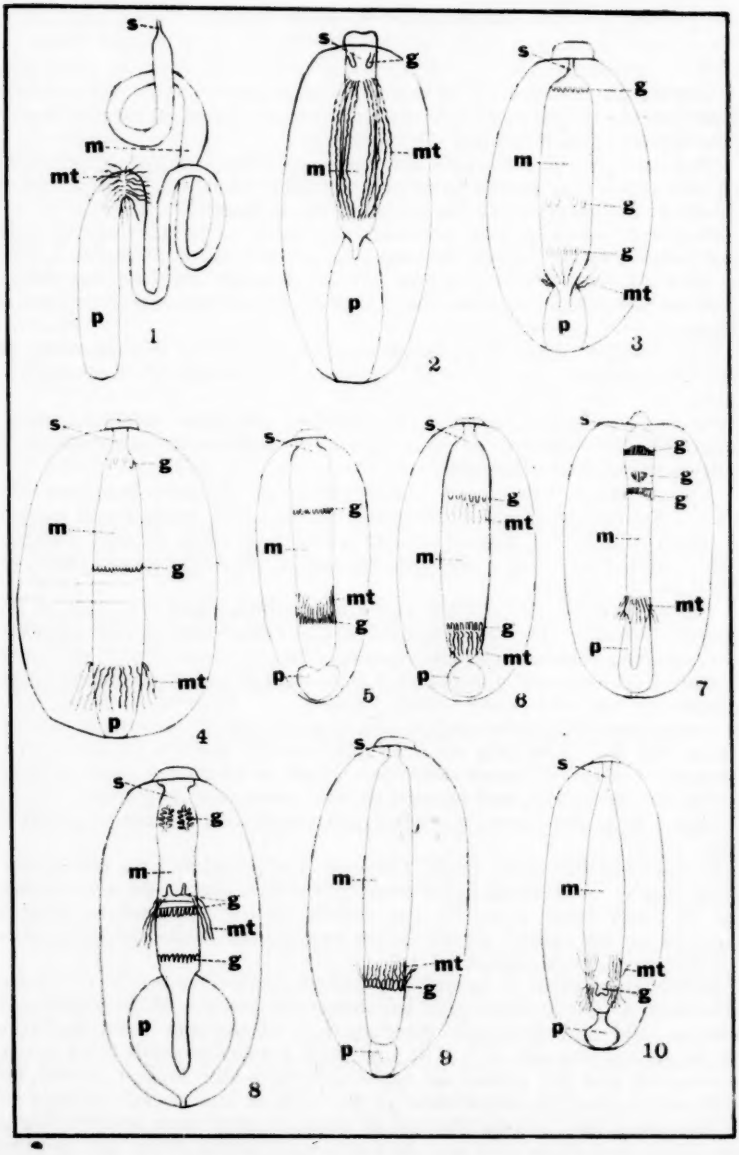
A species of *Pelidnota* (tribe Rutelini) was found to have two sets of gastric caeca (fig. 4). A few large lobes occur on the fore part of the ventriculus and a series of small lobes occurs in the middle of the ventriculus. The large lobes appear on the ventral surface of the ventriculus, while the series of small lobes encircles the ventriculus.

In the Dynastinae, a species of *Dynastes* (tribe Dynastini) was found to have two sets of gastric caeca: one set about one quarter of the distance from the anterior end and the other three-quarters of the way from the anterior end of the ventriculus (fig. 5). The first set is a series of small lobes encircling the ventriculus and the second set varies in length—the longest on the lateral wall and the shortest in the middle of the ventral and dorsal surfaces.

Two species in the tribe Oryctini of the Dynastinae were studied: *Ligyrodes relictus* (Say) and *Xyloryctes* sp. In *Ligyrodes relictus* there are two sets of gastric caeca, one on the fore part of the ventriculus and one on the hind part

*Contributions from the Entomological Laboratories of the University of Illinois, No. 273.

*Now at Doane College Crete, Nebraska



GASTRIC COECA OF SCARABAEOID LARVAE

Figure 1. *Cathon pilularius* (Linn.). 2. *Phyllophaga* sp. 3. *Popillia japonica* Newm. 4, *Pelidnota* sp.; 5. Dynastes sp., 6. *Ligyrodes reflectus* (Say); 7. *Xyloryctes* sp.; 8. *Osmoderma eremicola* Knoch; 9. *Dorcus* sp., 10. *Popilius disjunctus* Ill.. g, gastric coeca; mt, malpighian tubules; m, mesenteron; p, proctodaeum; s, stomodaeum.

(fig. 6). Both sets of caeca are the same shape and size. In the first set there is a smaller number of individual caeca, and in the second set the individual caeca are closer together, thus allowing a larger number of individual caeca. *Xyloryctes* has three sets of gastric caeca all located on the anterior portion of the ventriculus (fig. 7). The first set encircles the ventriculus with the longest caeca on the ventral and dorsal surfaces. The second set is located on the center of the ventral surface mid-way between sets one and three. A series of only a few lobes comprises the second set. The third set is similar to the first set except that the largest lobes are on the lateral surfaces and the shortest are on the dorsal and ventral surfaces.

The most specialized subfamily of the Scarabaeidae is the Cetoniinae and a specimen of *Osmoderma eremicola* Knoch (tribe Trichiini) was found to have four sets of gastric caeca (fig. 8). The first set is located on the fore part of the ventriculus and consists of two arborescent pouches. The second set is composed of two small pouches slightly cephalad of the middle. The third set is in the middle of the ventriculus and consists of a band of pouches extending around the ventriculus; the fourth set is located on the posterior end and is similar to the third set.

In the Lucanidae a specimen of *Dorcus* sp. was studied and found to have one set of gastric caeca on the posterior end of the ventriculus (fig. 9). The caeca are a series of oval lobes encircling the ventriculus.

In the Passalidae a specimen of *Popilius disjunctus* Ill. (*Passalus cornutus* Fab.) was examined and found to have one large lobe located on the posterior portion of the ventriculus (fig. 10).

It would appear that in the Scarabaeoidea the gastric caeca, when present, may number up to at least four sets. Further, the generally accepted belief that the gastric caeca are located at the anterior end of the mid-gut does not hold, since the gastric caeca in the Scarabaeoidea may be located on any portion of the ventriculus.

ACKNOWLEDGEMENTS

I wish to thank Professor William P. Hayes for the specimens used in this study and for many helpful suggestions while I was engaged in this work. Mr. C. H. Hadley, of the Japanese Beetle Laboratory, Moorestown, New Jersey, kindly supplied me with some Japanese beetle larvae.

INTERNATIONAL CONGRESS OF ENTOMOLOGY

The eighth International Congress of Entomology will be held in Stockholm, Sweden, August 9-15, 1948. The fact that all steamship sailings are currently booked to capacity for months in advance makes it seem necessary for those expecting to attend the congress in 1948 to arrange for passage as early as possible. Steamship companies have not issued sailing lists for 1948, but expect to do so in the early fall. A number of lines have listed sailings for the present season, among them, the Cunard, French, Belgian, Swedish, Norwegian, Gdynia (Polish), Holland-American, etc., the first mentioned expecting soon to have two new steamers in service. It is understood that the Thirteenth International Congress of Zoology will be held in Paris some time in July, 1948, and it is hoped that all entomologists going to Stockholm will plan to attend the Zoological Congress also in order that the interests of the entomologists may be fully represented before the more comprehensive body. Should a sufficient number of individuals indicate that they expect to sail about mid June, it may be feasible to engage passage on the same steamer. Early information as to the probable number of participants is especially desired in order that the housing committee in Stockholm may make the necessary arrangements. The undersigned, as member of the executive committee, would appreciate it if he be kept informed as early as possible as to plans of those expecting to attend the sessions.

O. A. Johannsen,
Comsock Hall, C. U.
Ithaca N. Y. June 1947

ADDITIONAL NOTES ON COLEOPTERA TAKEN IN ESSEX COUNTY AND SOUTHERN ONTARIO, CANADA.

BY S. D. HICKS,
Plant Inspection Office, Windsor, Ont.

This list follows closely on the third of three previously published articles in the *Canadian Entomologist*. Mr. C. A. Frost of Framingham, Massachusetts, has checked and supplied me with identifications of all but two of the specimens. His generous interest in determining some of the beetles for which names have been difficult to obtain made this paper possible.

Records From Essex County

Cicindela duodecimguttata Dej. This species occurs at Ojibway on open sandy soil. Frost comments that a male of this species shows a deletion of the lower part of the middle band unlike any of the 55 in his collection.

Carabus maeander Fisch. According to a young Windsor collector R. Gowanlock, this species is not uncommon near his home. I have never seen it in the Niagara Peninsula. Several specimens are contained in the collection of Mr. A. Andrews, Detroit, Michigan. He states that it used to be easily taken in Michigan.

Ampedus apicatus Say. One specimen was taken by R. Gowanlock at Windsor in July, 1944.

Byrrhus difficilis Csy. One specimen was taken at Ojibway on July 8, 1944, by R. Gowanlock.

Rhizophagus bipunctatus Say. One specimen was taken from under the bark of *Quercus* sp. at Ojibway in early March, 1945.

Calligrapha rowena Knab. Four specimens had been collected by R. Gowanlock at Ojibway in mid-summer of 1944. Not a common Calligrapha anywhere, it appears to be established in Essex County. These specimens check with those in my collection from the Niagara Peninsula. They had been identified by Mr. W. J. Brown.

Anametis setosus Blatch. Mr. Frost agrees to the possibility of my identification of this unique in my collection. It was taken at LaSalle on June 2, 1946.

Xyleborus saxeseni Ratz. A specimen was cut from one of the many "pinholes" showing under the bark of a dying trunk of *Quercus bicolor*. It was collected at Ojibway on Jan. 30, 1944. Swaine (1918, Canad. Bark Beetles, Part 2, p. 127) states that it was not known to occur in Canada. Further, that this species is apparently identical in every way with European specimens contained at that time in the Canadian National Collection. It has not been recorded since by Brown as common to the two continents.

Records From Other Counties of Southern Ontario

Helophorus aquaticus L. This species was taken at Cape Crocker on the Bruce Peninsula, June 2, 1946, by G. Steyskal of Detroit, Michigan. Brown (1940, Canad. Ent., 72:70) states that he has seen no specimens west of the Ottawa region. It is common to Europe and North America.

Phengodes plumosa Oliv. A specimen was taken at Fonthill in June. It matches Blatchley's description very well.

Oxyporus lateralis Grav. One specimen was taken at Fonthill in June, 1941.

Contribution No. 65—Division of Plant Protection, Science Service, Dominion Department of Agriculture.

Amblyderus sp. Near *punctiger* Csy., according to Frost, this specimen was collected under a log on the beach at Bright's Grove near Sarnia in October, 1944.

Paratenetus gibbipennis Mots. One specimen was taken at Campden on June 14, 1941.

Trox striatus Melsh. Mr. Frost has a unique specimen of this scarce scarab in his collection. I collected my unique at Beamsville on April 16, 1941.

Apion turbulentum Gyll. This species was taken from the leaves of *Lespedeza* sp. at Fonthill in July, 1944.

Dorytomus vagenotatus Csy. One specimen was taken about three miles northwest of St. Catharines on April 12, 1942.

Magdalis austera substriga Fall. One specimen was taken at St. Catharines on June 8, 1937.

Magdalis pandura Fall. This species was taken at Campden on June 3, 1941.

Anthonomus molochinus Dietz. One specimen was taken at Coboconk on August 7, 1940.

PRELIMINARY REPORT ON THE EFFECT OF DDT UPON "SOW BUGS" OR "WOODLICE" (ONISCOIDA)

In vitro tests were conducted in Petri dishes (3½" x ¾"). Larvae and adult Oniscoida, species unidentified, were collected in a cellar in Guelph, Ontario, on March 13, 1946, and placed in the Petri dishes with moistened pieces of paper and single slices of potato one-half inch in diameter. Petri dishes containing both principle and control crustaceans were placed on laboratory tables and maintained at normal room temperature.

The dishes intended to contain principles were lightly dusted with Burroughs Wellcome and Company "Wellcome Brand Veterinary DDT Dispersible Powder CPL 6093," manufactured under British Patent No. 5478F4 (p. 261, A.N. 5558). This powder contains 32% DDT. Several oniscoids were placed in each dish.

At the end of fifteen minutes oniscoids exposed to the DDT showed signs of incoordination by walking backwards for short distances and losing control of their legs. After an hour and a half they frequently fell upon their backs and turned over again only with considerable effort. During the night, and over a total period of 21 hours, all principles died. The experiments were repeated twice with similar results. Throughout the tests the oniscoids in the control dishes remained normal and are still living at the time of writing, fourteen days after the trials were commenced.

Conclusions: (a) Initial tests with DDT indicate that it may be of practical value in controlling sow-bugs or wood-lice in greenhouses and dwellings. (b) The oniscoids are easily obtainable, simple to maintain in the laboratory, and form a convenient animal against which to check the efficacy of DDT powder in the strength used.

A. A. Kingscote.

NOTES ON THE SEASONAL DEVELOPMENT OF *MEDETERA ALDRICHII* WHEELER (DIPTERA, DOLICHOPIDAE) AS A PREDATOR OF THE DOUGLAS FIR BARK-BEETLE, *DENDROCTONUS PSEUDOTSUGAE* HOPKINS (1)

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In 1935, De Leon[3] published a comprehensive paper on *Medetera aldrichii* as a predator of *Dendroctonus monticolae* Hopk., in western white pine and lodgepole pine in Washington. The following data may prove of value because a different species of bark-beetle is involved and additional information is given. The observations were made in 1941 and 1942 at the Trinity Valley Forest Insect Field Station, 22 miles from Vernon. This locality is 2,100 feet above sea level in a mixed timber stand of western larch, Douglas fir, western red cedar, Engelmann spruce, western hemlock, and western white pine. *D. pseudotsugae* breeds in Douglas fir, and occasionally in western larch.

SEASONAL DEVELOPMENT

In 1941, adults of *Medetera aldrichii* were first seen running over the bark of a felled tree on June 5. Egg laying continued from June 12 to August 8. The presence of adults ovipositing over this long period suggests more than one generation a year but apparently there is only one. The places of oviposition bear no relationship to the location of bark-beetle entrance holes. When seeking crevices in which to lay eggs the female proceeds along the tree trunk in a series of short rapid movements travelling forwards, sideways, or backwards with equal ease, pausing now and then to explore the bark crevices with her ovipositor.

The egg is placed as near to the bast layer as possible, the process taking about one minute. As a rule only 1 egg is placed in a crevice, but in several cases 2 or 3 were found together. Although it is difficult to locate the eggs because of their small size and the roughness of the bark, 8 eggs were dug out and the development observed.

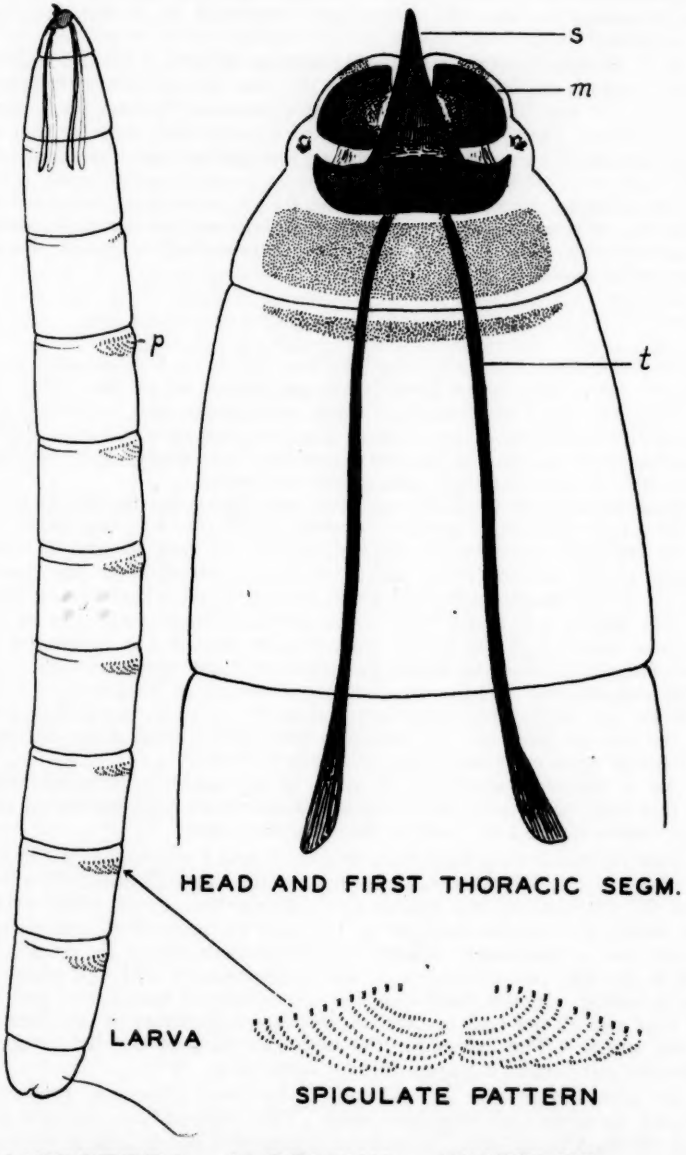
When first deposited, the egg is pearly white, 0.90 mm. long, 0.21 mm. thick, more pointed at one end and slightly curved. Within a few hours the egg becomes a light amber colour and after a day assumes a dark amber shade which remains up to the time of hatching. Movement of the larva can be seen several hours before hatching. The incubation period is about 9 days.

A recently emerged larva is 0.95 mm. long, and very slim. It makes its way directly through the bast layer with relative ease.

Apparently eggs are laid only on trees attacked by bark-beetles and the larva usually finds its prey in a short time. During its development period 1 larva was observed to destroy 5 bark-beetle larvae but it would be difficult to determine the number destroyed under field conditions. The predators move about considerably beneath the bark and the direction of their path is not necessarily determined by bark-beetle or borer tunnels. In passing over areas where there are no insect tunnels, the larvae leave dark, hair-line tracks between the inner bark and sapwood. Although bark-beetle larvae seem to be the principal food, *aldrichii* has been observed feeding on larvae of *Cerambycidae* and *Buprestidae* commonly found in Douglas fir. *M. aldrichii* prepares a pupal cell in the frass beneath the bark. This cell is usually lined with a thin, transparent cocoon, but occasionally larvae pupate without spinning cocoons. Just prior to pupation the larva is doubled up in a "U" or "J" shape.

1. Contribution No. 2506, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Ontario.

[3]De Leon, Donald—A study of *Medetera aldrichii* Wh. (Diptera-Dolichopodidae), a predator of the mountain pine beetle (*Dendroctonus monticolae* Hopk., Coleoptera, Scolytidae), Ent. Americana 15 (2):59-91, 1935.



MEDETERA ALDRICHII WHEELER

In 1942, larvae in the field commenced to spin up on April 25. Practically all had pupated by May 20. The pupal period varied from 30 to 33 days. Adults first appeared in the field insectary on May 29 but in cheesecloth field cages they began to emerge on May 20. Emergence continued from that date to July 7 with no definite peak.

On first thought it seems remarkable that so delicate a fly can make its way out from beneath the bark. However, by the time the adults are ready to emerge the bark of the tree has become considerably loosened by bark-beetle and secondary borer work. The frass becomes churned up and fairly loose so that it is possible for the flies to struggle to bark-beetle exit holes or to those made by other borers.

In living specimens, the eyes of the fly are iridescent green, but turn red after death. When distended with eggs, the abdomen has a considerable area of dark red on each side. This bleaches out in preserved or mounted specimens. Otherwise the adults are black.

Populations

In 1941, two trees (No. 1 and 2) were felled on May 20 and two (No. 3 and 4) on June 20 in order to study the population of predators and parasites of *D. pseudotsugae*. Analyses were made later by cutting sections 1-foot long from each trunk at intervals of 5 feet. The bark was removed from each section and larval counts made. Then the inner bark was shaved into fine pieces in order to find larvae which had entered the bast layer.

Examination of the first two trees was made during the latter part of July. No. 3 was examined in early September and No. 4 in late October.

In the first two trees, *M. aldrichii* larvae averaged 10 and 12 respectively compared to 53 and 49 living bark-beetle stages respectively per square foot. In the third tree, the averages were 3.8 fly larvae and 45.5 bark-beetles per square foot. The fourth tree had 2.2 fly larvae and 23.2 bark-beetles per square foot. From these analyses of the surface area of each tree it was calculated that the total number of *M. aldrichii* larvae in each of the four trees was 1027, 1340, 1021 and 235 respectively. The corresponding numbers of bark-beetles were 6619, 7101, 8915, and 2858. The trees varied from 13 to 16 inches D.B.H. and from 89 to 109 feet in total height. Samples were taken only as far up the trunk as bark-beetle work extended which averaged 55 feet.

All of the trees studied were lying in an east-west direction and it was found that there were more *Medetera* larvae and more bark-beetles on the north and undersides of the logs than on the other two sides.

One log 8-feet long from each of trees 1 and 3 was caged in the spring of 1942. From No. 1, 129 adult bark-beetles emerged and 25 adult *M. aldrichii* or 3.7 and 0.7 respectively per square foot. From No. 3, 588 adult bark-beetles and 34 adult *M. aldrichii* emerged or 11.4 and 0.7 respectively per square foot. This indicates a bark-beetle mortality of 93 percent and a fly mortality of 93 percent in the first tree between time of examination in July and emergence the following spring. In the third tree, the mortalities of bark-beetle and fly were 77 per cent and 82 per cent respectively between September of one year and the following spring. The causes for the high mortality of the fly larvae are not fully known but fungus is responsible for some of it.

De Leon stated that *M. aldrichii* is the most important predator of *D. monticolae* in white and lodgepole pine. This may not be the case with the Douglas fir bark-beetle since *Enoclerus sphegeus* Fab. is also a very effective predator. The two logs examined in July had an average of 5.2 and 4.8 *E. sphegeus* larvae per square foot. The other two logs were examined so late that practically all the clerid larvae had left them to go into hibernation. While the population of *aldrichii* larvae is often greater, evidence indicates that an *Enoclerus* larva destroys more bark-beetles of all stages than does M. aldrichii.

In the accompanying illustration, some of the more salient characters of the larva of *M. aldrichii* are shown. There are two stout mandibular plates (m), a median spine (s) which is used to puncture the victim, and two metacephalic and two tentorial rods (t) which can be seen with the naked eye as a single short black line. On the anterior ventral portion of each abdominal segment except the caudal one, there is a raised spiculate area (p). These roughened pseudopods assist in locomotion.

SUMMARY

Medetera aldrichii Wheeler is an important predator of the Douglas fir bark-beetle, *Dendroctonus pseudotsugae* Hopk., in the southern interior of British Columbia. Log analyses have shown that the larval population of this fly sometimes averages 10 per square foot of log surface compared to bark-beetle populations varying from 23 to 63 per square foot. Evidence indicates that each *M. aldrichii* larva, during its development, destroys several bark-beetle larvae. The eggs of *M. alrichii* are laid in crevices of the bark between mid-June and early August. Eggs hatch in about 9 days. Larvae overwinter in the trees and pupate during late April and in May of the following year. Over 1200 larvae are sometimes present in one tree. The pupal period lasts about one month. In one tree, bark-beetles suffered a mortality of 93 per cent between July of one year and the time of emergence the following year. *M. aldrichii* also suffered 93 per cent mortality during the same period. In another tree, mortality of both the bark-beetle and fly was 77 per cent and 82 per cent, respectively, between September of one year and time of emergence the following year. Only one other predator, *Enoclerus sphegeus* Fab. seems to be as effective as *M. aldrichii*.

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